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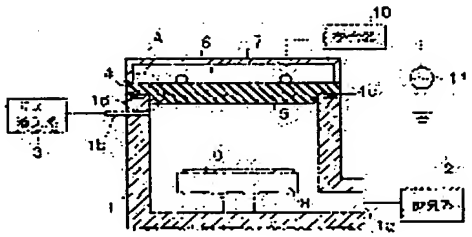
(54) PROCESSING DEVICE AND PLASMA DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To solve the problems wherein processing is carried out using high-density plasma or light having high irradiance or high energy in recent years, and the plasma or light reaches an O ring penetrating through a gap, in the joined part of a hermetically sealed unit which is kept hermetic using the O ring to spoil the O ring or to react on active seeds, such as oxygen active seeds or the like.
SOLUTION: A plasma blocking means 12 formed of conductive and shape-memory member is provided to the processing chamber 1 side (inside) of the O ring 4 so as to restrain active seeds produced from plasma and processing gas from reaching the O ring 4, impurities are prevented from being discharged out or the O ring 4 is protected against deterioration, and a substrate 9 to be processed is protected against contamination.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]
The tight container which generates the plasma within the ambient atmosphere of the introduced raw gas,
The airtight maintenance means for being placed between closure face-to-face with the dielectric window part attached as the whole surface of said tight container, and holding an airtight condition,
The processor characterized by coming to provide the plasma cutoff means fabricated by the configuration which is prepared in the interior side of said tight container rather than the location in which said airtight maintenance means was formed, consists of a conductive ingredient, and has stability on said closure side.
[Claim 2]
Said plasma cutoff means is formed of a conductive member. The configuration The configuration which made said conductive member thin band-like, and was wound around the spiral, the configuration which made said conductive member thin band-like, and was cast crosswise annular [with bending], The configuration which used said conductive member as lead wire, and was wound around the solenoid coil configuration or the configuration which used as said lead wire and was knit up into tubed, the processor according to claim 1 by which it is being [it / any one **] characterized.
[Claim 3]
The tight container which generates the plasma within the ambient atmosphere of the introduced raw gas,
The airtight maintenance means for intervening between planes of composition with the dielectric window part attached as the whole surface of said tight container, and holding an airtight condition,
The gas cutoff means established on one [at least] opposed face by the side of the interior of said tight container rather than the location in which it became from the member with a reaction factor higher than the member which forms said tight container with the active species generated from said raw gas, and said airtight maintenance means was formed,
The processor characterized by coming to provide.
[Claim 4]
The tight container which generates the plasma within the ambient atmosphere of the introduced raw gas,
The airtight maintenance means for being placed between closure face-to-face with the dielectric window part attached as the whole surface of said tight container, and holding an airtight condition,
The gas cutoff means which consists of a conductive member formed on the field which goes in said tight container of said airtight maintenance means,
The processor characterized by coming to provide.
[Claim 5]
The tight container for performing processing accompanied by the photolysis by light energy

within the ambient atmosphere of the introduced raw gas,
The airtight maintenance means for being placed between closure face-to-face with the light transmission window part attached as the whole surface of said tight container, and holding an airtight condition,
The light source prepared in the non-plane-of-composition side in said light transmission window part,
A protection-from-light means by which the light which said light source emitted is prepared on the optical path which tends toward said airtight maintenance means, and shades said light,
The processor characterized by providing.
[Claim 6]
Said raw gas is claims 1, 3, and 4 and the processor of any one publication of five which are characterized by consisting of reactant gas which contains an oxygen atom in a presentation at least.
[Claim 7]
Said processor,
The gas cutoff means which consists of a member with a reaction factor higher than the location in which said airtight maintenance means was formed with the active species generated from said raw gas rather than said tight container ingredient prepared on each field of the 1st field including the closure side established in the interior side of said tight container, and the 2nd field of said configuration part which stands face to face against the 1st field,
The processor according to claim 5 characterized by furthermore providing.
[Claim 8]
The tight container which generates the plasma,
The wall in which a part of container wall surface which constitutes this tight container is prepared airtightly free [attachment and detachment],
The O ring which carries out the seal of the opposite section of this wall and said container wall surface airtightly,
The plasma cutoff means established inside [said / chamber] this O ring,
Plasma equipment characterized by coming to provide.
[Claim 9]
Said plasma cutoff means is plasma equipment according to claim 13 characterized by being at least one means of an annular metal wire production object, an annular metal plate manufacturing spring, and an annular metal beam object.
[Claim 10]
The tight container with which raw gas is supplied,
The wall in which a part of container wall surface which constitutes this tight container is prepared airtightly free [attachment and detachment],
The harmful gas adsorption means established on the opposed face of said wall and said container wall surface in the opposite section of this wall and said container wall surface,
Plasma equipment characterized by coming to provide.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates [be / it / under / tight container / setting] to the processor and plasma equipment which perform plasma treatment, processing by photoactivation gas, etc.
[0002]
[Description of the Prior Art]
Generally, in order to manufacture a semiconductor device, plasma-CVD (Chemical Vapor Deposition) equipment, a sputtering system, an etching system, etc. are used, and membrane formation and etching are performed by the plasma treatment in a vacuum. This vacuum is made by the airtight processing chamber in which the exhaust air system was prepared, and is. This processing chamber is formed in box-like by being made from aluminum or stainless steel, and the delivery device for performing delivery with the conveyance system of the gas feed system for introducing the electrode for plasma generating, process gas, etc., the semi-conductor substrate (wafer) taken out from the exterior in carrying in or the exterior, or the substrate for displays etc. is prepared in that interior. Moreover, two or more openings, such as a port for connecting the gate and the exhaust air system for a conveyance system, are prepared in the processing chamber.
[0003]
When attaching a configuration part in these openings, respectively, in order to give airtightness, it is attached on both sides of the member for airtight maintenance (seal member). As this member for airtight maintenance, the O ring which consists of a metallic gasket, rubber, etc. is mainly used. A metallic gasket is used for the flange junction to a processing chamber among these in many cases. Although airtightness is high and has endurance also to heat or raw gas (corrosive gas and the gas of oxygen active species are included), since this metallic gasket cannot be used repeatedly, it is that it is thrown away. On the other hand, the O ring is used as an airtight sealant, in case the gate lid and viewing port (glass) which are opened and closed each time are attached in a processing chamber as an aperture, in order to take a wafer in and out. That is, it is used to the part which cannot use metallic gaskets opened and closed repeatedly, such as a part and glass.
[0004]
[Patent reference 1]
JP,5-315262,A (paragraph number [0012] - [0015]),
[0005]
[Patent reference 2]
JP,5-315261,A (paragraph number [0013]),
[0006]
[Patent reference 3]
A JP,2002-217137,A official report, -(paragraph number [0014) [0018
[0007]
[Patent reference 4]

A JP,2002-164685,A official report, (paragraph number [0015) [0020
[0008]
[Problem(s) to be Solved by the Invention]
The O ring mentioned above can be repeatedly used as a seal member, and since it is cheap, it is used abundantly at the vacuum processor. However, in substrate processing, when the oxygen active species (here an oxygen atom or ozone etc.) generated with raw gas, for example, oxygen gas, in plasma treatment or a gas ambient atmosphere are contained, an O ring is exposed to the plasma or oxygen active species, the front face of an O ring reacts chemically, and an O ring deteriorates. Moreover, since impurities, such as carbon and a fluorine, are emitted into a processing ambient atmosphere from an O ring with this reaction, there is a possibility that an impurity may permeate in a processed substrate. In usual oxidation treatment and etching processing, reactant gas including oxygen gas is used in many cases. As this cure, although the O ring of corrosion resistance can also be used, it is a large sum and product cost will be affected.
[0009]
A crevice is prepared inside the location in which the O ring was attached by the processing chamber body in the patent reference 1 there, and this crevice and the heights which fit in are prepared in the configuration part side to attach. When this configuration part is attached in a processing chamber body, a crevice and heights fit in, and it is devised so that raw gas and the plasma may be surroundings-lump-hard and may become. Moreover, by arranging cutoff parts, such as a fluororesin, inside an O ring, the patent reference 2 has proposed the technique of preventing degradation of an O ring, as the plasma and raw gas did not contact an O ring.
[0010]
Generally, the clearance between configuration parts for an O ring to perform airtight maintenance is supposed that about 0.1-0.3mm carries out suitable. However, there is change of the clearance by the curvature and distortion which were generated in a part for a joint by change of the clearance by degree-of-hardness change of the O ring by aging, the hysteresis of the heat in a processor, etc. By change of this clearance, these plasma and raw gas turn to a clearance, infiltrate into it, and reach to an O ring.
[0011]
Moreover, the patent reference 3 is indicating the technique of maintaining the optimal clearance using a resin stopper so that an O ring may be crushed moderately and airtightness can be maintained. If the stopper which consists of a resin ingredient currently indicated is exposed to the plasma or raw gas (active species), since he can consider reacting and emitting the organic substance, the clearance which prevents encroachment of the plasma or raw gas is specified.
[0012]
However, in recent years, optical high processing of energy is used strongly [the high density plasma or exposure reinforcement] from want to high integration of a device, or improvement in the speed of processing speed, and the plasma and light have trespassed also upon the about 0.1-0.3mm clearance considered to be the optimal at the former.
As what prevents encroachment of this plasma, the configuration parts (for example, a processing chamber and a lid) which arrange dip coiled spring to the periphery side of an O ring, and are joined are electrically connected to the patent reference 4, and the technique of performing magnetic shielding is indicated. Since dip coiled spring is arranged at the periphery side of an O ring and an O ring exists in a plasma side (inside), it is possible that the O ring is exposed to the plasma with this patent reference 4.
[0013]
Then, this invention aims at offering the processor and plasma equipment which prevent the breakage to the airtight maintenance means by the raw gas containing the active species used for the plasma generated under a vacuum ambient atmosphere, or processing.
[0014]
[Means for Solving the Problem]
The tight container which generates the plasma within the ambient atmosphere of the introduced raw gas in order that this invention may attain the above-mentioned object, The airtight

maintenance means for being placed between closure face-to-face with the dielectric window part attached as the whole surface of said tight container, and holding an airtight condition, and on said closure side It is prepared in the interior side of said tight container rather than the location in which said airtight maintenance means was formed, and the processor which comes to provide the plasma cutoff means fabricated by the configuration which consists of a conductive ingredient and has stability is offered.

[0015]

Moreover, it is the configuration and any one ** which said plasma cutoff means was formed of the conductive member, and used as the configuration which the configuration made said conductive member thin band-like, and was wound around the spiral, the configuration which made said conductive member thin band-like, and was cast crosswise annular [with bending], the configuration which used said conductive member as lead wire, and was wound around the solenoid coil configuration, or said lead wire, and were knit up into tubed.

[0016]

Furthermore, the plasma equipment which comes to provide the tight container which generates the plasma, the wall in which a part of container wall surface which constitutes this tight container is prepared airtightly free [attachment and detachment], the O ring which carries out the seal of the opposite section of this wall and said container wall surface airtightly, and the plasma cutoff means established inside [said / chamber] this O ring is offered.

[0017]

The above processors and plasma equipment of a configuration form the airtight maintenance means which consists of an O ring the plasma cutoff means which consists of a conductive member of the configuration which has stability in a processing chamber side, intercept that the active species generated by the plasma and raw gas reaches to an O ring, and bleedoff of an impurity and degradation of an O ring are prevented.

[0018]

[Embodiment of the Invention]

Hereafter, the operation gestalt of this invention is explained to a detail with reference to a drawing.

Drawing 1 is the sectional view showing the notional whole configuration of inductive-coupling mold plasma treatment equipment as 1st operation gestalt which applied the processor of this invention. Drawing 2 is drawing showing the cross-section configuration to which a part for the airtight attaching part of a vacuum processor was expanded.

[0019]

The gas feed system 3 which this vacuum processor is connected with the processing chamber 1 which consists of aluminum, stainless steel, etc., and the exhaust air system 2 connected to exhaust port 1a of the processing chamber 1 at gas inlet 1b, and introduces raw gas, purge gas, etc. into a tight container 1, for example, a processing chamber, is established. Opening of the top face of this processing chamber 1 is carried out, and a round is covered, 1d of circular sulci is formed in that annular up edge 1c, and as an airtight maintenance means, O ring 4 which consists of a rubber ingredient is exposed to 1d of this circular sulcus in part, and is inserted in it. When the hermetic seal (closure) of this exposure is carried out, it is spacing in which Clearance G is formed.

[0020]

Furthermore, the internal wall (dielectric window part) 5 formed with dielectrics, such as glass, is attached so that O ring 4 may be crushed proper to annular up edge 1c of the processing chamber 1 and it may become airtight to it. The coil 6 (up electrode) for plasma production is arranged on the top face (chamber outside) of this dielectric window part 5. Furthermore, the top cover 7 is attached above the dielectric window part 5 so that the coil 6 for plasma production may be covered. It may attach so that a lid 7 may besides press the dielectric window part 5, and you may make it function as crushing O ring 4 of annular up edge 1c proper, and giving the airtightness in the processing chamber 1. The table (lower electrode) 8 which has the function to hold the processed substrates 9, such as a semi-conductor wafer and a substrate for displays, and to perform the temperature control of this processed substrate 9 is formed in the pars

basilaris ossis occipitalis in the processing chamber 1.
[0021]
Carrying-in appearance of this processed substrate 9 is carried out through the gate in which the side attachment wall of the processing chamber 1 was prepared and which is not illustrated. Or switching operation of the dielectric window part 5 is carried out, and the processed substrate 9 can also take the processed substrate 9 in and out of the upper part. The coil 6 for plasma production mentioned above is connected to RF generator 11 which outputs 13.56MHz high-frequency power through the adjustment machine 10. In addition, in the following explanation, the wall side (or processing room side) of the processing chamber 1 called the inside, and has called the outside the outer wall side of the processing chamber 1.
[0022]
The waveguide connected to the microwave power source for generating the plasma can also be formed in the top face (chamber outside) of the dielectric window part 5.
[0023]
Although this processor explains as an example the plasma membrane formation processor (CVD) which forms an oxide film, of course, it is not limited to this, and applies and is effective in the airtight maintenance means by O ring 4 of the processor by the plasma and/, or reactant gas. As a processor which has an airtight maintenance means, there are plasma-CVD equipment, a heat CVD system, a photon assisted CVD system, a sputtering system, an etching system, Usher equipment, etc., for example.
[0024]
Next, the airtight maintenance means A shown in drawing 2 is explained.
When the periphery section of the dielectric window part 5 and annular up edge 1c of the processing chamber 1 opposite-**, the hermetic seal of this airtight maintenance means A is carried out. Circular-sulcus 1e same inside 1d of circular sulci in which O ring 4 of this annular up edge 1c was inserted (processing room side) is formed. When the hermetic seal of the plasma cutoff means 12 formed in the configuration which has stability like a spring with a conductive ingredient is carried out, it is inserted in this circular-sulcus 1e so that it may expose in part. This plasma cutoff means 12 consists of conductive members, such as an ingredient, for example, a metal etc., which is not corroded by the plasma which contacts. What rolled the metaled thin long and slender (band-like) steel plate in the shape of a spiral as a configuration of a plasma cutoff means may be used, and you may knit up into the thing which coiled lead wire around the solenoid coil configuration, or tubed.
[0025]
As a metal of this plasma cutoff means 12, stainless steel, aluminum, copper, iron, etc. these alloys, etc. are assumed. Moreover, surface treatment of corrosion-proof may be performed to these metals and alloys. The same is said of the conductive part which can set the following operation gestalten.
[0026]
When the dielectric window part 5 and annular up edge 1c are joined, the plasma cutoff means 12 contacts these both, and if airtightness is realized when an O ring is crushed, the width of face of Clearance G will not be limited. However, the width of face of this clearance G reaches [the plasma permeates to the plasma cutoff means 12, and] for example, has a desirable clearance 0.1mm or less.
[0027]
Next, the example of down stream processing is explained. As a processed object substrate 9, for example, a semi-conductor wafer is carried in in the processing chamber 1, and is laid on a table 8. Then, after the exhaust air system 2 exhausts atmospheric air and purge gas in the processing chamber 1 and reaches the set-up degree of vacuum, it introduces oxygen gas (O2) as raw gas from a gas feed system 3, and forms the oxygen ambient atmosphere maintained by the predetermined pressure. Subsequently, high-frequency power is switched on in the processing chamber 1 through the dielectric window part 5 from the coil 6 for plasma production, and the plasma of an oxygen ambient atmosphere is generated. By this plasma, the active species generated from raw gas occurs. In addition, as this raw gas, activated gas, such as

oxygen gas, and the reactant gas which has corrosive [which is used for RIE etc.] shall also be included. In the following operation gestalten, although oxidation treatment by the active species (oxygen active species) generated by oxygen gas is explained as an example, it is not limited to this. Here, oxygen active species is taken as oxygen active species including the active species of others containing not only active oxygen but oxygen ion (O+, O2+), or ozone and an oxygen atom.

[0028]

By furthermore heating a semi-conductor wafer at about 300 degrees C, plasma oxidation of the silicon of a semi-conductor wafer is carried out. In this oxidation treatment, silicon oxide with a depth (thickness) of about 6nm is formed from a front face of the processing time for about 30 minutes.

[0029]

To this silicon oxide, using SIMS (Secondary Ion Mass spectroscopy:ion [secondary] mass spectrometry), the amount of fluorines in silicon oxide is measured, the plasma cutoff means 12 is not established like the example which prepared the plasma cutoff means 12 and the O ring like this operation gestalt, and before, but the example only by the O ring is explained. As a measurement result, the relation between the depth from the front face of silicon oxide with a thickness of 6nm and a fluorine atom consistency is shown in drawing 3 .

[0030]

According to this drawing 3 , in the example which did not establish the plasma cutoff means 12 only with conventional O ring 4, many fluorines contain in silicon oxide until the depth of the silicon oxide formed as shown by the dotted line exceeds 5nm. On the other hand, in the example which established the plasma cutoff means 12 by this operation gestalt, it became clear that a fluorine atom consistency became three or less 1019 atoms/cm also on a front face, and was decreasing double figures compared with the former as shown by the continuous line.

[0031]

According to this operation gestalt, it can prevent that the plasma and raw gas affect it to O ring 4 as mentioned above by arranging the plasma cutoff means 12 which consists of a conductive member of the configuration which has stability inside O ring 4. If it pulls, impurities generated from O ring 4, such as carbon and a fluorine, can prevent permeating into the processed substrate 9. Furthermore, the plasma cutoff means 12 prevents being spread in the processing chamber 1, even if impurities, such as carbon and a fluorine, are generated from O ring 4. Moreover, if the organic substance is used for the ingredient of the plasma cutoff means 12, when exposed to the plasma, bleedoff of an impurity will pose a problem, but bleedoff of an impurity can be prevented if the ingredient is a metal (conductor). Furthermore, since the metallic material is thermally more stable, the temperature of the processed substrate 9 is desirable to oxidation treatment which is about 300 degrees C.

[0032]

Next, the airtight maintenance means 12 in the vacuum processor concerning the 2nd operation gestalt is explained. Drawing 4 (a) is drawing in which showing the cross-section structure of annular up edge 1c of the processing chamber 1, and showing the cross-section structure of the airtight maintenance means B in the condition that annular up edge 1c and the opposite section of the dielectric window part 5 were joined to drawing 4 (b). As an equipment configuration, it is equivalent to the configuration shown in drawing 1 in the configuration except being illustrated. moreover, the same about a part equivalent to the 1st operation gestalt mentioned above by the configuration part of this operation gestalt -- it carries out with a reference mark and the explanation is omitted.

[0033]

As shown in drawing 4 (a), O ring 4 and the plasma cutoff means 22 are arranged at annular up edge 1c of the processing chamber 1. Inside the slot in which O ring 4 was inserted, a round of annular up edge 1c is covered, and the annular slit 21 is formed. The plasma cutoff means 22 is formed in band-like like a flat spring with the sheet metal which consists of a metallic material, and it bends and it is fabricated so that it may insert crosswise [the] with beam section 22a and may have section 22b in it. Plug partial 22b of this plasma cutoff means 22 covers a round,

and is airtightly inserted in the annular slit 21. If the thickness of this sheet metal is thickness which has stability like a spring, its thinner one is good.

[0034]

And it contacts that there is no clearance in the dielectric window part 5, beam section 22a of the plasma cutoff means 22 being pushed on the dielectric window part 5, and bending, when annular up edge 1c and the dielectric window part 5 are joined, as shown in drawing 4 (b). With this, O ring 4 is crushed proper and airtightness is realized.

[0035]

The plasma cutoff means 22 intercepts the plasma and the plasma can be prevented from making it reach even to O ring 4 like this 2nd operation gestalt ****** and the 1st operation gestalt. It can prevent carbon, fluorine gas, etc. occurring from an O ring by this, and being spread in the processing chamber 1. Moreover, it can produce cheaply with an easy configuration, and the maintenance of washing, exchange, etc. can be performed easily. furthermore — if it is narrow, for example, the clearance G between annular up edge 1c at the time of junction and the dielectric window part 5 is made to 0.1mm or less — raw gas — since — — the generated active species also stops being able to permeate easily

[0036]

Next, the airtight maintenance means of the vacuum processor concerning the 3rd operation gestalt is explained. Drawing 5 (a) shows the cross-section structure of the annular up edge of a processing chamber, and drawing 5 (b) is drawing showing the cross-section structure of the airtight attaching part part C in the condition that annular up edge 1c and the dielectric window part 5 were joined. in addition, the same about a part equivalent to the 1st operation gestalt mentioned above by the configuration part of this operation gestalt here — it carries out with a reference mark and the explanation is omitted.

[0037]

As shown in drawing 5 (a), O ring 4 and the plasma cutoff means 23 are arranged at annular up edge 1c of the processing chamber 1. Crosswise, this plasma cutoff means 23 uses drawing molding and press molding for annular [which consists of beam section 23a and installation section 23b], and is produced. It is arranged inside O ring 4, installation section 23b is airtightly fixed to the Zagury part 24 of annular up edge 1c, and this plasma cutoff means 23 is in the condition that beam section 23a started up.

[0038]

It is made to contact that there is no clearance in the dielectric window part 5, beam section 23a of the plasma cutoff means 23 being pushed on the dielectric window part 5, and bending, when annular up edge 1c and the dielectric window part 5 are joined, as shown in drawing 5 (b). Furthermore, proper **** of O ring 4 is carried out, and airtightness is realized.

[0039]

The plasma cutoff means 23 intercepts encroachment of the plasma, and can be prevented from making even O ring 4 reach like this 3rd operation gestalt ****** and the 1st operation gestalt. Moreover, it can produce cheaply with an easy configuration, and the maintenance of washing, exchange, etc. can be performed easily. if the clearance G between the top face of annular up edge 1c at the time of junction and a dielectric window part 5 side-attachment-wall side is narrowly made to 0.1mm or less also in this operation gestalt — raw gas — since — the generated active species also stops being able to permeate easily

[0040]

Although the plasma cutoff means 22 and 23 in the 2nd and 3rd operation gestalt mentioned above were formed with the metallic material, they may produce this with a shape memory alloy, may form a heater etc. in near, and they may start it so that the dielectric window part 5 may be contacted in the plasma cutoff means 22 and 23 at the time of operation.

[0041]

Moreover, in the operation gestalt of the 1st, and 2 and 3 mentioned above, since it be the dielectric window part 5 which the configuration part join even if it establish the plasma cutoff means 12, 22, and 23 inside O ring 4 (processing chamber 1 side) become from glass, friction with the plasma cutoff means 12, 22, and 23 be small, and since it be hard to generate, particle

hardly affect it to the processed substrate 9. Moreover, generating of particle can be lessened more by choosing glass with a degree of hardness, or carrying out consolidation processing of the glass front face, or grinding so that a front face may become smooth further.

[0042]

Next, the airtight maintenance means of the vacuum processor concerning the 4th operation gestalt is explained. As shown in drawing 6 , with this operation gestalt, coat 24a to which the raw gas which has invaded into the inside [O ring / 4 /f / of internal-surface upper parts of annular up edge 1c of the processing chamber 1 / 1 / and / of annular up edge 1c following this] top-face part, for example, active species, is made to stick by surface reaction (dissipation) is formed. Moreover, the same coat 24b as field 5a of the dielectric window part 5 which stands face to face against coat 24a of annular up edge 1c at the time of junction is formed.

[0043]

It is the coat which functions as oxygen adsorption material, for example, when the processing chamber 1 is formed by stainless steel, a reaction factor (surface loss factor) with oxygen should be just larger than an equipment wall as a coat ingredient, and these coats 24a and 24b have aluminum (aluminum), a tantalum (Ta), or a desirable ingredient with a big surface loss factor called nickel (nickel). As the formation approach of these coats 24a and 24b, it may form with vacuum deposition or the spraying process sprayed directly may be used. Moreover, the clearance G between annular up edge 1c of the processing chamber at the time of junction and the dielectric window part 5 has a desirable clearance 0.1mm or less within the limits of 0-0.3mm.

[0044]

In membrane formation of an oxide film, by preparing coat 5a by the member with a surface loss factor higher than an equipment wall and the dielectric window part 5 in the trespass path of oxygen active species, oxygen active species is made to react or recombine on the front face of coat 5a, and it becomes possible with this operation gestalt to decrease the amount of the active species which reaches and reacts to O ring 4.

[0045]

Like the operation gestalt of the 1st and 2 mentioned above also in this operation gestalt, plasma oxidation was given to the semi-conductor wafer and the fluorine atom consistency in silicon oxide checked having fallen compared with the former like the case where silicon oxide is formed. In addition, although the example applied to oxygen gas was explained, it is applicable here by choosing suitably the coat ingredient which carries out suitable similarly in other process gas.

[0046]

Next, the airtight maintenance means E of the vacuum processor concerning the 5th operation gestalt is explained.

[0047]

To O ring 4 inserted in annular up edge 1c of the processing chamber 1 as shown in drawing 7 , this operation gestalt uses a metallic film 25 for O ring 4 front face by the side of a vacuum, and forms plating or the sputtering method in it. Since elastics modulus (expansion coefficient) differ, as for O ring 4 and a metallic film 25, a crack and peeling become easy to generate all the front faces of O ring 4 with a metallic film 25 at the time of a wrap and telescopic motion of O ring 4. Then, as for a metallic film 25, it is desirable to form in a part of O ring 4 front face. As an ingredient of a metallic film 25, an ingredient with the elasticity near O ring 4 (soft) is desirable in the semantics which prevents a crack. Copper, aluminum, or platinum can be considered as an ingredient of this metallic film 25.

[0048]

Since it was lost according to this operation gestalt that the plasma and active species touch directly to O ring 4, the high impurity concentration which pollutes the processed substrate 9 can be reduced greatly, and can acquire effectiveness equivalent to the 1st operation gestalt mentioned above. In addition, this metallic film does not necessarily need to be based on a metallic material, and the impurity which is generated when the plasma and active species are

touched, and poses a problem should just form the coat by the ingredient which is not contained in the presentation. Since it is lost that the organic substance which constitutes O ring 4, and active species react by this, bleedoff of impurities, such as a fluorine and carbon, can be controlled and degradation of O ring 4 can be prevented.

[0049]

Next, drawing 8 is the cross-section block diagram showing the notional whole configuration of the optical processor using the xenon excimer lamp as 6th operation gestalt which applied the vacuum processor of this invention. Drawing 9 is drawing showing the cross-section configuration to which the airtight maintenance means of a vacuum processor was expanded. in addition, the same about a part equivalent to the 1st operation gestalt mentioned above by the configuration part of this operation gestalt here -- it carries out with a reference mark and the explanation is omitted.

[0050]

This vacuum processor consists of the processing chamber 1 mentioned above, the exhaust air system 2, a gas feed system 3, O ring 4 for planning airtightness, the internal wall (light transmission window part) 31 by transparent quartz glass etc., a xenon excimer lamp (a lamp is called hereafter) 32 arranged on the top face (chamber outside) of this light transmission window part 31, a top cover 7, and a lamp power source 33 for making a lamp 32 emit light. The processed substrate 9 is held at the pars basilaris ossis occipitalis in the processing chamber 1, and the table 8 which has the processing temperature-control function of the processed substrate 9 is formed in it. Moreover, it has the gate which the carrying-in delivery volume of the processed substrate 9 does not illustrate. In this vacuum processor, annular up edge 1c of the processing chamber 1 and the light transmission window part 31 make O ring 4 intervene, and are realizing the airtight.

[0051]

After this vacuum processor exhausts the inside of the processing chamber 1 and reaches a predetermined degree of vacuum, it generates the oxygen ambient atmosphere of the pressure for which introducesOgas feed system 2 gas by three, and it asks. light (light energy) with a wavelength [with a lamp 32] of 172nm is emitted to this oxygen ambient atmosphere, and the photolysis of the O2 gas is carried out -- making -- the inside of the processing chamber 1 -- base -- an atom and ozone are generated and the front face of the processed substrate 9 heated by 300 degrees C on the table 8 is oxidized.

[0052]

In this configuration, the synchrotron orbital radiation from a lamp 32 will penetrate the light transmission window part 31, and will be irradiated by O ring 4. When it irradiates, O ring 4 deteriorates by strong ultraviolet radiation. Furthermore, since oxygen active species is generated by this synchrotron orbital radiation also around O ring 4, O ring 4 and oxygen active species react, and impurities, such as carbon and a fluorine, are emitted from O ring 4. Then, this operation gestalt forms a gobo 34 on the optical path of the synchrotron orbital radiation which faces to O ring 4 from a lamp 32, and shades the synchrotron orbital radiation irradiated by O ring 4. This gobo 34 can consider a refractory metal etc. that what is necessary is to be able to shade synchrotron orbital radiation and to just be formed with the ingredient which does not dissolve with the heat of the light source. Of course, raw gas is not restricted to oxygen gas and can be applied to the raw gas which has corrosive [which is used for processing of the membrane formation to the processed substrate 9, etching, diffusion, etc.].

[0053]

The optical processor of this operation gestalt can prepare a gobo on the optical path of a lamp 32 and O ring 4, as shown in drawing 5 , it can lose that light is irradiated to O ring 4 and its neighborhood, and can prevent the reaction of O ring 4 and oxygen active species.

[0054]

Although this invention which more than explained can acquire effectiveness to all the equipments that use O ring 4 for the airtight maintenance means, it is most effective that a plasma consistency applies to a high part within equipment. Since the activity of airtight maintenance means other than O ring 4 is difficult for the part to which the dielectric window

part 5 shown in the operation gestalt of the 1st and 2 mentioned above and a processing chamber are joined as a means for being the part where a plasma consistency is the highest, and making it airtight, the effectiveness of this invention is demonstrated most.

[0055]

Moreover, in the vacuum processor about plasma treatment equipment, it cannot be based on the class of source of the plasma, but effectiveness can be acquired. Moreover, the energy for decomposing not only the plasma but material gas should just be supplied.

[0056]

Furthermore, also in the airtight maintenance means of the optical processor using the xenon excimer lamp as the light source, since the exposure of the light to O ring 4 was shaded, generating of active species, such as oxygen active species, can be controlled degradation of O ring 4 and near an O ring. [by ultraviolet radiation]

[0057]

Moreover, it can do [applying to the lamp heat chamber carried in each annealer which used the incandescence ball, halogen lamp, and flash lamp other than an optical processor in this operation gestalt, and membrane formation equipments (CVD etc.), or].

[0058]

In addition, in each operation gestalt mentioned above, it is also possible to carry out combining each operation gestalt.

As the 1st example, as shown in drawing 10 (a), it prevents that intercept the plasma with the plasma cutoff means 12, adsorb active species with Coats 24a and 24b, and the plasma and active species reach O ring 4 by combining the plasma cutoff means 12 in the 1st operation gestalt, and the coats 24a and 24b which function as oxygen adsorption material in the 4th operation gestalt.

[0059]

As shown in drawing 10 (b), even if the plasma and active species which passed the plasma cutoff means 12 may reach O ring 4 as the 2nd example according to the configuration which combined O ring 4 of the plasma cutoff means 12 in the 1st operation gestalt, and the 5th operation gestalt, degradation of O ring 4 can be prevented. Furthermore, even if the plasma and active species which have passed the plasma cutoff means 12 and Coats 24a and 24b combining the 5th operation gestalt to the 1st example may reach O ring 4, degradation of O ring 4 can be prevented. Similarly, the same effectiveness can be acquired if the 4th and 5th operation gestalt is combined also to the 2nd and 3rd operation gestalt, respectively.

[0060]

As the 3rd example, as shown in drawing 10 (c), it can prevent that adsorb the active species by the raw gas which occurred in the photolysis with Coats 24a and 24b, and active species reaches O ring 4 by combining the vacuum processor of the 6th operation gestalt, and the coats 24a and 24b which function as oxygen adsorption material in the 4th operation gestalt.

[0061]

As shown in drawing 10 (d), even if the active species by the raw gas which occurred in the photolysis by combining the vacuum processor of the 6th operation gestalt and O ring 4 with which the metallic film 25 in the 5th operation gestalt was formed, for example, oxygen active species, may reach O ring 4 as the 4th example, degradation of O ring 4 can be prevented. Moreover, the 5th operation gestalt may be combined with the 3rd example.

[0062]

Although the above-mentioned operation gestalt explained the example which carries out the seal of the dielectric used as an electromagnetic wave passage aperture for generating the plasma airtightly, you may apply to the airtight maintenance means of the metal closing motion valve which a processed object is made to frequent.

[0063]

[Effect of the Invention]

As explained in full detail above, according to this invention, the vacuum processor which prevents the breakage to the airtight maintenance lumber by the raw gas containing the oxygen active species used for the plasma generated under a vacuum ambient atmosphere or processing

can be offered.

[Brief Description of the Drawings]

[Drawing 1] It is the cross-section block diagram showing the notional whole configuration of the inductive-coupling mold plasma treatment equipment concerning the 1st operation gestalt which applied the vacuum processor of this invention.

[Drawing 2] It is drawing showing the cross-section configuration to which a part for the airtight attaching part of the vacuum processor of the 1st operation gestalt was expanded.

[Drawing 3] It is drawing showing the relation between the depth from the front face of the silicon oxide in the 1st operation gestalt, and a fluorine atom consistency.

[Drawing 4] Drawing 4 (a) is drawing showing the cross-section configuration of the annular up edge of the processing chamber concerning the 2nd operation gestalt, and drawing showing the cross-section structure in the condition that the annular up edge and the dielectric window part were joined to drawing 4 (b).

[Drawing 5] Drawing and drawing 5 (b) which show the cross-section structure of the annular up edge of the processing chamber which drawing 5 (a) requires for the 3rd operation gestalt are drawing showing the cross-section structure in the condition that the annular up edge and the dielectric window part were joined.

[Drawing 6] It is drawing for explaining the airtight maintenance means of the vacuum processor concerning the 4th operation gestalt.

[Drawing 7] It is drawing for explaining the airtight maintenance means of the vacuum processor concerning the 5th operation gestalt.

[Drawing 8] It is cross-section structural drawing showing the notional whole configuration of the optical processor using the xenon excimer lamp concerning the 6th operation gestalt which applied the vacuum processor of this invention.

[Drawing 9] It is drawing showing the cross-section structure to which a part for the airtight maintenance hand part of the vacuum processor in drawing 8 was expanded.

[Drawing 10] It is drawing showing the example of a configuration which combined the 1st thru/or 6th operation gestalt.

[Description of Notations]

1 — processing chamber and 1a— an exhaust port, a 1b— gas inlet, a 1c— annular up edge, and 1d— a circular sulcus, 2 — exhaust air system, 3 — gas feed system, and 4 — an O ring, the interior wall (dielectric window part) of 5 —, the coil for 6 — plasma production, and 7 — a top cover, 8 — table (lower electrode), 9 — substrate, and 10 — an adjustment machine, 11 — RF generator, and 12 — plasma cutoff means.

[Translation done.]

* NOTICES *

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TECHNICAL FIELD

[Field of the Invention]
This invention relates [be / it / under / tight container / setting] to the processor and plasma equipment which perform plasma treatment, processing by photoactivation gas, etc.
[0002]

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PRIOR ART

[Description of the Prior Art]
Generally, in order to manufacture a semiconductor device, plasma-CVD (Chemical Vapor Deposition) equipment, a sputtering system, an etching system, etc. are used, and membrane formation and etching are performed by the plasma treatment in a vacuum. This vacuum is made by the airtight processing chamber in which the exhaust air system was prepared, and is. This processing chamber is formed in box-like by being made from aluminum or stainless steel, and the delivery device for performing delivery with the conveyance system of the gas feed system for introducing the electrode for plasma generating, process gas, etc., the semi-conductor substrate (wafer) taken out from the exterior in carrying in or the exterior, or the substrate for displays etc. is prepared in that interior. Moreover, two or more openings, such as a port for connecting the gate and the exhaust air system for a conveyance system, are prepared in the processing chamber.
[0003]
When attaching a configuration part in these openings, respectively, in order to give airtightness, it is attached on both sides of the member for airtight maintenance (seal member). As this member for airtight maintenance, the O ring which consists of a metallic gasket, rubber, etc. is mainly used. A metallic gasket is used for the flange junction to a processing chamber among these in many cases. Although airtightness is high and has endurance also to heat or raw gas (corrosive gas and the gas of oxygen active species are included), since this metallic gasket cannot be used repeatedly, it is that it is thrown away. On the other hand, the O ring is used as an airtight sealant, in case the gate lid and viewing port (glass) which are opened and closed each time are attached in a processing chamber as an aperture, in order to take a wafer in and out. That is, it is used to the part which cannot use metallic gaskets opened and closed repeatedly, such as a part and glass.
[0004]
[Patent reference 1]
JP,5-315262,A (paragraph number [0012] - [0015]),
[0005]
[Patent reference 2]
JP,5-315261,A (paragraph number [0013]),
[0006]
[Patent reference 3]
A JP,2002-217137,A official report, -(paragraph number [0014) [0018
[0007]
[Patent reference 4]
A JP,2002-164685,A official report, (paragraph number [0015) [0020
[0008]

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EFFECT OF THE INVENTION

[Effect of the Invention]
As explained in full detail above, according to this invention, the vacuum processor which prevents the breakage to the airtight maintenance lumber by the raw gas containing the oxygen active species used for the plasma generated under a vacuum ambient atmosphere or processing can be offered.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]
The O ring mentioned above can be repeatedly used as a seal member, and since it is cheap, it is used abundantly at the vacuum processor. However, in substrate processing, when the oxygen active species (here an oxygen atom or ozone etc.) generated with raw gas, for example, oxygen gas, in plasma treatment or a gas ambient atmosphere are contained, an O ring is exposed to the plasma or oxygen active species, the front face of an O ring reacts chemically, and an O ring deteriorates. Moreover, since impurities, such as carbon and a fluorine, are emitted into a processing ambient atmosphere from an O ring with this reaction, there is a possibility that an impurity may permeate in a processed substrate. In usual oxidation treatment and etching processing, reactant gas including oxygen gas is used in many cases. As this cure, although the O ring of corrosion resistance can also be used, it is a large sum and product cost will be affected.
[0009]
A crevice is prepared inside the location in which the O ring was attached by the processing chamber body in the patent reference 1 there, and this crevice and the heights which fit in are prepared in the configuration part side to attach. When this configuration part is attached in a processing chamber body, a crevice and heights fit in, and it is devised so that raw gas and the plasma may be surroundings-lump-hard and may become. Moreover, by arranging cutoff parts, such as a fluororesin, inside an O ring, the patent reference 2 has proposed the technique of preventing degradation of an O ring, as the plasma and raw gas did not contact an O ring.
[0010]
Generally, the clearance between configuration parts for an O ring to perform airtight maintenance is supposed that about 0.1-0.3mm carries out suitable. However, there is change of the clearance by the curvature and distortion which were generated in a part for a joint by change of the clearance by degree-of-hardness change of the O ring by aging, the hysteresis of the heat in a processor, etc. By change of this clearance, these plasma and raw gas turn to a clearance, infiltrate into it, and reach to an O ring.
[0011]
Moreover, the patent reference 3 is indicating the technique of maintaining the optimal clearance using a resin stopper so that an O ring may be crushed moderately and airtightness can be maintained. If the stopper which consists of a resin ingredient currently indicated is exposed to the plasma or raw gas (active species), since he can consider reacting and emitting the organic substance, the clearance which prevents encroachment of the plasma or raw gas is specified.
[0012]
However, in recent years, optical high processing of energy is used strongly [the high density plasma or exposure reinforcement] from want to high integration of a device, or improvement in the speed of processing speed, and the plasma and light have trespassed also upon the about 0.1-0.3mm clearance considered to be the optimal at the former.
As what prevents encroachment of this plasma, the configuration parts (for example, a processing chamber and a lid) which arrange dip coiled spring to the periphery side of an O ring, and are joined are electrically connected to the patent reference 4, and the technique of

performing magnetic shielding is indicated. Since dip coiled spring is arranged at the periphery side of an O ring and an O ring exists in a plasma side (inside), it is possible that the O ring is exposed to the plasma with this patent reference 4.
[0013]
Then, this invention aims at offering the processor and plasma equipment which prevent the breakage to the airtight maintenance means by the raw gas containing the active species used for the plasma generated under a vacuum ambient atmosphere, or processing.
[0014]

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MEANS

[Means for Solving the Problem]
The tight container which generates the plasma within the ambient atmosphere of the introduced raw gas in order that this invention may attain the above-mentioned object, The airtight maintenance means for being placed between closure face-to-face with the dielectric window part attached as the whole surface of said tight container, and holding an airtight condition, and on said closure side It is prepared in the interior side of said tight container rather than the location in which said airtight maintenance means was formed, and the processor which comes to provide the plasma cutoff means fabricated by the configuration which consists of a conductive ingredient and has stability is offered.
[0015]
Moreover, it is the configuration and any one ** which said plasma cutoff means was formed of the conductive member, and used as the configuration which the configuration made said conductive member thin band-like, and was wound around the spiral, the configuration which made said conductive member thin band-like, and was cast crosswise annular [with bending], the configuration which used said conductive member as lead wire, and was wound around the solenoid coil configuration, or said lead wire, and were knit up into tubed.
[0016]
Furthermore, the plasma equipment which comes to provide the tight container which generates the plasma, the wall in which a part of container wall surface which constitutes this tight container is prepared airtightly free [attachment and detachment], the O ring which carries out the seal of the opposite section of this wall and said container wall surface airtightly, and the plasma cutoff means established inside [said / chamber] this O ring is offered.
[0017]
The above processors and plasma equipment of a configuration form the airtight maintenance means which consists of an O ring the plasma cutoff means which consists of a conductive member of the configuration which has stability in a processing chamber side, intercept that the active species generated by the plasma and raw gas reaches to an O ring, and bleedoff of an impurity and degradation of an O ring are prevented.
[0018]
[Embodiment of the Invention]
Hereafter, the operation gestalt of this invention is explained to a detail with reference to a drawing.
Drawing 1 is the sectional view showing the notional whole configuration of inductive-coupling mold plasma treatment equipment as 1st operation gestalt which applied the processor of this invention. Drawing 2 is drawing showing the cross-section configuration to which a part for the airtight attaching part of a vacuum processor was expanded.
[0019]
The gas feed system 3 which this vacuum processor is connected with the processing chamber 1 which consists of aluminum, stainless steel, etc., and the exhaust air system 2 connected to exhaust port 1a of the processing chamber 1 at gas inlet 1b, and introduces raw gas, purge gas, etc. into a tight container 1, for example, a processing chamber, is established. Opening of the

top face of this processing chamber 1 is carried out, and a round is covered, 1d of circular sulci is formed in that annular up edge 1c, and as an airtight maintenance means, O ring 4 which consists of a rubber ingredient is exposed to 1d of this circular sulcus in part, and is inserted in it. When the hermetic seal (closure) of this exposure is carried out, it is spacing in which Clearance G is formed.

[0020]

Furthermore, the internal wall (dielectric window part) 5 formed with dielectrics, such as glass, is attached so that O ring 4 may be crushed proper to annular up edge 1c of the processing chamber 1 and it may become airtight to it. The coil 6 (up electrode) for plasma production is arranged on the top face (chamber outside) of this dielectric window part 5. Furthermore, the top cover 7 is attached above the dielectric window part 5 so that the coil 6 for plasma production may be covered. It may attach so that a lid 7 may besides press the dielectric window part 5, and you may make it function as crushing O ring 4 of annular up edge 1c proper, and giving the airtightness in the processing chamber 1. The table (lower electrode) 8 which has the function to hold the processed substrates 9, such as a semi-conductor wafer and a substrate for displays, and to perform the temperature control of this processed substrate 9 is formed in the pars basilaris ossis occipitalis in the processing chamber 1.

[0021]

Carrying-in appearance of this processed substrate 9 is carried out through the gate in which the side attachment wall of the processing chamber 1 was prepared and which is not illustrated. Or switching operation of the dielectric window part 5 is carried out, and the processed substrate 9 can also take the processed substrate 9 in and out of the upper part. The coil 6 for plasma production mentioned above is connected to RF generator 11 which outputs 13.56MHz high-frequency power through the adjustment machine 10. In addition, in the following explanation, the wall side (or processing room side) of the processing chamber 1 called the inside, and has called the outside the outer wall side of the processing chamber 1.

[0022]

The waveguide connected to the microwave power source for generating the plasma can also be formed in the top face (chamber outside) of the dielectric window part 5.

[0023]

Although this processor explains as an example the plasma membrane formation processor (CVD) which forms an oxide film, of course, it is not limited to this, and applies and is effective in the airtight maintenance means by O ring 4 of the processor by the plasma and/, or reactant gas. As a processor which has an airtight maintenance means, there are plasma-CVD equipment, a heat CVD system, a photon assisted CVD system, a sputtering system, an etching system, Usher equipment, etc., for example.

[0024]

Next, the airtight maintenance means A shown in drawing 2 is explained.

When the periphery section of the dielectric window part 5 and annular up edge 1c of the processing chamber 1 opposite-**, the hermetic seal of this airtight maintenance means A is carried out. Circular-sulcus 1e same inside 1d of circular sulci in which O ring 4 of this annular up edge 1c was inserted (processing room side) is formed. When the hermetic seal of the plasma cutoff means 12 formed in the configuration which has stability like a spring with a conductive ingredient is carried out, it is inserted in this circular-sulcus 1e so that it may expose in part. This plasma cutoff means 12 consists of conductive members, such as an ingredient, for example, a metal etc., which is not corroded by the plasma which contacts. What rolled the metaled thin long and slender (band-like) steel plate in the shape of a spiral as a configuration of a plasma cutoff means may be used, and you may knit up into the thing which coiled lead wire around the solenoid coil configuration, or tubed.

[0025]

As a metal of this plasma cutoff means 12, stainless steel, aluminum, copper, iron, etc. these alloys, etc. are assumed. Moreover, surface treatment of corrosion-proof may be performed to these metals and alloys. The same is said of the conductive part which can set the following operation gestalten.

[0026]
When the dielectric window part 5 and annular up edge 1c are joined, the plasma cutoff means 12 contacts these both, and if airtightness is realized when an O ring is crushed, the width of face of Clearance G will not be limited. However, the width of face of this clearance G reaches [the plasma permeates to the plasma cutoff means 12, and] for example, has a desirable clearance 0.1mm or less.
[0027]
Next, the example of down stream processing is explained. As a processed object substrate 9, for example, a semi-conductor wafer is carried in in the processing chamber 1, and is laid on a table 8. Then, after the exhaust air system 2 exhausts atmospheric air and purge gas in the processing chamber 1 and reaches the set-up degree of vacuum, it introduces oxygen gas (O2) as raw gas from a gas feed system 3, and forms the oxygen ambient atmosphere maintained by the predetermined pressure. Subsequently, high-frequency power is switched on in the processing chamber 1 through the dielectric window part 5 from the coil 6 for plasma production, and the plasma of an oxygen ambient atmosphere is generated. By this plasma, the active species generated from raw gas occurs. In addition, as this raw gas, activated gas, such as oxygen gas, and the reactant gas which has corrosive [which is used for RIE etc.] shall also be included. In the following operation gestalten, although oxidation treatment by the active species (oxygen active species) generated by oxygen gas is explained as an example, it is not limited to this. Here, oxygen active species is taken as oxygen active species including the active species of others containing not only active oxygen but oxygen ion (O+, O2+), or ozone and an oxygen atom.
[0028]
By furthermore heating a semi-conductor wafer at about 300 degrees C, plasma oxidation of the silicon of a semi-conductor wafer is carried out. In this oxidation treatment, silicon oxide with a depth (thickness) of about 6nm is formed from a front face of the processing time for about 30 minutes.
[0029]
To this silicon oxide, using SIMS (Secondary Ion Mass spectroscopy:ion [secondary] mass spectrometry), the amount of fluorines in silicon oxide is measured, the plasma cutoff means 12 is not established like the example which prepared the plasma cutoff means 12 and the O ring like this operation gestalt, and before, but the example only by the O ring is explained. As a measurement result, the relation between the depth from the front face of silicon oxide with a thickness of 6nm and a fluorine atom consistency is shown in drawing 3 .
[0030]
According to this drawing 3 , in the example which did not establish the plasma cutoff means 12 only with conventional O ring 4, many fluorines contain in silicon oxide until the depth of the silicon oxide formed as shown by the dotted line exceeds 5nm. On the other hand, in the example which established the plasma cutoff means 12 by this operation gestalt, it became clear that a fluorine atom consistency became three or less 1019 atoms/cm also on a front face, and was decreasing double figures compared with the former as shown by the continuous line.
[0031]
According to this operation gestalt, it can prevent that the plasma and raw gas affect it to O ring 4 as mentioned above by arranging the plasma cutoff means 12 which consists of a conductive member of the configuration which has stability inside O ring 4. If it pulls, impurities generated from O ring 4, such as carbon and a fluorine, can prevent permeating into the processed substrate 9. Furthermore, the plasma cutoff means 12 prevents being spread in the processing chamber 1, even if impurities, such as carbon and a fluorine, are generated from O ring 4. Moreover, if the organic substance is used for the ingredient of the plasma cutoff means 12, when exposed to the plasma, bleedoff of an impurity will pose a problem, but bleedoff of an impurity can be prevented if the ingredient is a metal (conductor). Furthermore, since the metallic material is thermally more stable, the temperature of the processed substrate 9 is desirable to oxidation treatment which is about 300 degrees C.
[0032]

Next, the airtight maintenance means 12 in the vacuum processor concerning the 2nd operation gestalt is explained. Drawing 4 (a) is drawing in which showing the cross-section structure of annular up edge 1c of the processing chamber 1, and showing the cross-section structure of the airtight maintenance means B in the condition that annular up edge 1c and the opposite section of the dielectric window part 5 were joined to drawing 4 (b). As an equipment configuration, it is equivalent to the configuration shown in drawing 1 in the configuration except being illustrated. moreover, the same about a part equivalent to the 1st operation gestalt mentioned above by the configuration part of this operation gestalt — it carries out with a reference mark and the explanation is omitted.

[0033]

As shown in drawing 4 (a), O ring 4 and the plasma cutoff means 22 are arranged at annular up edge 1c of the processing chamber 1. Inside the slot in which O ring 4 was inserted, a round of annular up edge 1c is covered, and the annular slit 21 is formed. The plasma cutoff means 22 is formed in band-like like a flat spring with the sheet metal which consists of a metallic material, and it bends and it is fabricated so that it may insert crosswise [the] with beam section 22a and may have section 22b in it. Plug partial 22b of this plasma cutoff means 22 covers a round, and is airtightly inserted in the annular slit 21. If the thickness of this sheet metal is thickness which has stability like a spring, its thinner one is good.

[0034]

And it contacts that there is no clearance in the dielectric window part 5, beam section 22a of the plasma cutoff means 22 being pushed on the dielectric window part 5, and bending, when annular up edge 1c and the dielectric window part 5 are joined, as shown in drawing 4 (b). With this, O ring 4 is crushed proper and airtightness is realized.

[0035]

The plasma cutoff means 22 intercepts the plasma and the plasma can be prevented from making it reach even to O ring 4 like this 2nd operation gestalt ****** and the 1st operation gestalt. It can prevent carbon, fluorine gas, etc. occurring from an O ring by this, and being spread in the processing chamber 1. Moreover, it can produce cheaply with an easy configuration, and the maintenance of washing, exchange, etc. can be performed easily. furthermore — if it is narrow, for example, the clearance G between annular up edge 1c at the time of junction and the dielectric window part 5 is made to 0.1mm or less — raw gas — since — — the generated active species also stops being able to permeate easily

[0036]

Next, the airtight maintenance means of the vacuum processor concerning the 3rd operation gestalt is explained. Drawing 5 (a) shows the cross-section structure of the annular up edge of a processing chamber, and drawing 5 (b) is drawing showing the cross-section structure of the airtight attaching part part C in the condition that annular up edge 1c and the dielectric window part 5 were joined. in addition, the same about a part equivalent to the 1st operation gestalt mentioned above by the configuration part of this operation gestalt here — it carries out with a reference mark and the explanation is omitted.

[0037]

As shown in drawing 5 (a), O ring 4 and the plasma cutoff means 23 are arranged at annular up edge 1c of the processing chamber 1. Crosswise, this plasma cutoff means 23 uses drawing molding and press molding for annular [which consists of beam section 23a and installation section 23b], and is produced. It is arranged inside O ring 4, installation section 23b is airtightly fixed to the Zagury part 24 of annular up edge 1c, and this plasma cutoff means 23 is in the condition that beam section 23a started up.

[0038]

It is made to contact that there is no clearance in the dielectric window part 5, beam section 23a of the plasma cutoff means 23 being pushed on the dielectric window part 5, and bending, when annular up edge 1c and the dielectric window part 5 are joined, as shown in drawing 5 (b). Furthermore, proper **** of O ring 4 is carried out, and airtightness is realized.

[0039]

The plasma cutoff means 23 intercepts encroachment of the plasma, and can be prevented from

making even O ring 4 reach like this 3rd operation gestalt ****** and the 1st operation gestalt. Moreover, it can produce cheaply with an easy configuration, and the maintenance of washing, exchange, etc. can be performed easily. if the clearance G between the top face of annular up edge 1c at the time of junction and a dielectric window part 5 side-attachment-wall side is narrowly made to 0.1mm or less also in this operation gestalt — raw gas — since — the generated active species also stops being able to permeate easily

[0040]

Although the plasma cutoff means 22 and 23 in the 2nd and 3rd operation gestalt mentioned above were formed with the metallic material, they may produce this with a shape memory alloy, may form a heater etc. in near, and they may start it so that the dielectric window part 5 may be contacted in the plasma cutoff means 22 and 23 at the time of operation.

[0041]

Moreover, in the operation gestalt of the 1st, and 2 and 3 mentioned above, since it be the dielectric window part 5 which the configuration part join even if it establish the plasma cutoff means 12, 22, and 23 inside O ring 4 (processing chamber 1 side) become from glass, friction with the plasma cutoff means 12, 22, and 23 be small, and since it be hard to generate, particle hardly affect it to the processed substrate 9. Moreover, generating of particle can be lessened more by choosing glass with a degree of hardness, or carrying out consolidation processing of the glass front face, or grinding so that a front face may become smooth further.

[0042]

Next, the airtight maintenance means of the vacuum processor concerning the 4th operation gestalt is explained. As shown in drawing 6 , with this operation gestalt, coat 24a to which the raw gas which has invaded into the inside [O ring / 4 /f / of internal-surface upper parts of annular up edge 1c of the processing chamber 1 / 1 / and / of annular up edge 1c following this] top-face part, for example, active species, is made to stick by surface reaction (dissipation) is formed. Moreover, the same coat 24b as field 5a of the dielectric window part 5 which stands face to face against coat 24a of annular up edge 1c at the time of junction is formed.

[0043]

It is the coat which functions as oxygen adsorption material, for example, when the processing chamber 1 is formed by stainless steel, a reaction factor (surface loss factor) with oxygen should be just larger than an equipment wall as a coat ingredient, and these coats 24a and 24b have aluminum (aluminum), a tantalum (Ta), or a desirable ingredient with a big surface loss factor called nickel (nickel). As the formation approach of these coats 24a and 24b, it may form with vacuum deposition or the spraying process sprayed directly may be used. Moreover, the clearance G between annular up edge 1c of the processing chamber at the time of junction and the dielectric window part 5 has a desirable clearance 0.1mm or less within the limits of 0-0.3mm.

[0044]

In membrane formation of an oxide film, by preparing coat 5a by the member with a surface loss factor higher than an equipment wall and the dielectric window part 5 in the trespass path of oxygen active species, oxygen active species is made to react or recombine on the front face of coat 5a, and it becomes possible with this operation gestalt to decrease the amount of the active species which reaches and reacts to O ring 4.

[0045]

Like the operation gestalt of the 1st and 2 mentioned above also in this operation gestalt, plasma oxidation was given to the semi-conductor wafer and the fluorine atom consistency in silicon oxide checked having fallen compared with the former like the case where silicon oxide is formed. In addition, although the example applied to oxygen gas was explained, it is applicable here by choosing suitably the coat ingredient which carries out suitable similarly in other process gas.

[0046]

Next, the airtight maintenance means E of the vacuum processor concerning the 5th operation gestalt is explained.

[0047]
To O ring 4 inserted in annular up edge 1c of the processing chamber 1 as shown in drawing 7 , this operation gestalt uses a metallic film 25 for O ring 4 front face by the side of a vacuum, and forms plating or the sputtering method in it. Since elastics modulus (expansion coefficient) differ, as for O ring 4 and a metallic film 25, a crack and peeling become easy to generate all the front faces of O ring 4 with a metallic film 25 at the time of a wrap and telescopic motion of O ring 4. Then, as for a metallic film 25, it is desirable to form in a part of O ring 4 front face. As an ingredient of a metallic film 25, an ingredient with the elasticity near O ring 4 (soft) is desirable in the semantics which prevents a crack. Copper, aluminum, or platinum can be considered as an ingredient of this metallic film 25.
[0048]
Since it was lost according to this operation gestalt that the plasma and active species touch directly to O ring 4, the high impurity concentration which pollutes the processed substrate 9 can be reduced greatly, and can acquire effectiveness equivalent to the 1st operation gestalt mentioned above. In addition, this metallic film does not necessarily need to be based on a metallic material, and the impurity which is generated when the plasma and active species are touched, and poses a problem should just form the coat by the ingredient which is not contained in the presentation. Since it is lost that the organic substance which constitutes O ring 4, and active species react by this, bleedoff of impurities, such as a fluorine and carbon, can be controlled and degradation of O ring 4 can be prevented.
[0049]
Next, drawing 8 is the cross-section block diagram showing the notional whole configuration of the optical processor using the xenon excimer lamp as 6th operation gestalt which applied the vacuum processor of this invention. Drawing 9 is drawing showing the cross-section configuration to which the airtight maintenance means of a vacuum processor was expanded. in addition, the same about a part equivalent to the 1st operation gestalt mentioned above by the configuration part of this operation gestalt here -- it carries out with a reference mark and the explanation is omitted.
[0050]
This vacuum processor consists of the processing chamber 1 mentioned above, the exhaust air system 2, a gas feed system 3, O ring 4 for planning airtightness, the internal wall (light transmission window part) 31 by transparent quartz glass etc., a xenon excimer lamp (a lamp is called hereafter) 32 arranged on the top face (chamber outside) of this light transmission window part 31, a top cover 7, and a lamp power source 33 for making a lamp 32 emit light. The processed substrate 9 is held at the pars basilaris ossis occipitalis in the processing chamber 1, and the table 8 which has the processing temperature-control function of the processed substrate 9 is formed in it. Moreover, it has the gate which the carrying-in delivery volume of the processed substrate 9 does not illustrate. In this vacuum processor, annular up edge 1c of the processing chamber 1 and the light transmission window part 31 make O ring 4 intervene, and are realizing the airtight.
[0051]
After this vacuum processor exhausts the inside of the processing chamber 1 and reaches a predetermined degree of vacuum, it generates the oxygen ambient atmosphere of the pressure for which introducesOgas feed system 2 gas by three, and it asks. light (light energy) with a wavelength [with a lamp 32] of 172nm is emitted to this oxygen ambient atmosphere, and the photolysis of the O2 gas is carried out -- making -- the inside of the processing chamber 1 -- base -- an atom and ozone are generated and the front face of the processed substrate 9 heated by 300 degrees C on the table 8 is oxidized.
[0052]
In this configuration, the synchrotron orbital radiation from a lamp 32 will penetrate the light transmission window part 31, and will be irradiated by O ring 4. When it irradiates, O ring 4 deteriorates by strong ultraviolet radiation. Furthermore, since oxygen active species is generated by this synchrotron orbital radiation also around O ring 4, O ring 4 and oxygen active species react, and impurities, such as carbon and a fluorine, are emitted from O ring 4. Then, this

operation gestalt forms a gobo 34 on the optical path of the synchrotron orbital radiation which faces to O ring 4 from a lamp 32, and shades the synchrotron orbital radiation irradiated by O ring 4. This gobo 34 can consider a refractory metal etc. that what is necessary is to be able to shade synchrotron orbital radiation and to just be formed with the ingredient which does not dissolve with the heat of the light source. Of course, raw gas is not restricted to oxygen gas and can be applied to the raw gas which has corrosive [which is used for processing of the membrane formation to the processed substrate 9, etching, diffusion, etc.].

[0053]

The optical processor of this operation gestalt can prepare a gobo on the optical path of a lamp 32 and O ring 4, as shown in drawing 5 , it can lose that light is irradiated to O ring 4 and its neighborhood, and can prevent the reaction of O ring 4 and oxygen active species.

[0054]

Although this invention which more than explained can acquire effectiveness to all the equipments that use O ring 4 for the airtight maintenance means, it is most effective that a plasma consistency applies to a high part within equipment. Since the activity of airtight maintenance means other than O ring 4 is difficult for the part to which the dielectric window part 5 shown in the operation gestalt of the 1st and 2 mentioned above and a processing chamber are joined as a means for being the part where a plasma consistency is the highest, and making it airtight, the effectiveness of this invention is demonstrated most.

[0055]

Moreover, in the vacuum processor about plasma treatment equipment, it cannot be based on the class of source of the plasma, but effectiveness can be acquired. Moreover, the energy for decomposing not only the plasma but material gas should just be supplied.

[0056]

Furthermore, also in the airtight maintenance means of the optical processor using the xenon excimer lamp as the light source, since the exposure of the light to O ring 4 was shaded, generating of active species, such as oxygen active species, can be controlled degradation of O ring 4 and near an O ring. [by ultraviolet radiation]

[0057]

Moreover, it can do [applying to the lamp heat chamber carried in each annealer which used the incandescence ball, halogen lamp, and flash lamp other than an optical processor in this operation gestalt, and membrane formation equipments (CVD etc.), or].

[0058]

In addition, in each operation gestalt mentioned above, it is also possible to carry out combining each operation gestalt.

As the 1st example, as shown in drawing 10 (a), it prevents that intercept the plasma with the plasma cutoff means 12, adsorb active species with Coats 24a and 24b, and the plasma and active species reach O ring 4 by combining the plasma cutoff means 12 in the 1st operation gestalt, and the coats 24a and 24b which function as oxygen adsorption material in the 4th operation gestalt.

[0059]

As shown in drawing 10 (b), even if the plasma and active species which passed the plasma cutoff means 12 may reach O ring 4 as the 2nd example according to the configuration which combined O ring 4 of the plasma cutoff means 12 in the 1st operation gestalt, and the 5th operation gestalt, degradation of O ring 4 can be prevented. Furthermore, even if the plasma and active species which have passed the plasma cutoff means 12 and Coats 24a and 24b combining the 5th operation gestalt to the 1st example may reach O ring 4, degradation of O ring 4 can be prevented. Similarly, the same effectiveness can be acquired if the 4th and 5th operation gestalt is combined also to the 2nd and 3rd operation gestalt, respectively.

[0060]

As the 3rd example, as shown in drawing 10 (c), it can prevent that adsorb the active species by the raw gas which occurred in the photolysis with Coats 24a and 24b, and active species reaches O ring 4 by combining the vacuum processor of the 6th operation gestalt, and the coats 24a and 24b which function as oxygen adsorption material in the 4th operation gestalt.

[0061]
As shown in drawing 10 (d), even if the active species by the raw gas which occurred in the photolysis by combining the vacuum processor of the 6th operation gestalt and O ring 4 with which the metallic film 25 in the 5th operation gestalt was formed, for example, oxygen active species, may reach O ring 4 as the 4th example, degradation of O ring 4 can be prevented. Moreover, the 5th operation gestalt may be combined with the 3rd example.
[0062]
Although the above-mentioned operation gestalt explained the example which carries out the seal of the dielectric used as an electromagnetic wave passage aperture for generating the plasma airtightly, you may apply to the airtight maintenance means of the metal closing motion valve which a processed object is made to frequent.
[0063]

[Translation done.]

* NOTICES *

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3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the cross-section block diagram showing the notional whole configuration of the inductive-coupling mold plasma treatment equipment concerning the 1st operation gestalt which applied the vacuum processor of this invention.
[Drawing 2] It is drawing showing the cross-section configuration to which a part for the airtight attaching part of the vacuum processor of the 1st operation gestalt was expanded.
[Drawing 3] It is drawing showing the relation between the depth from the front face of the silicon oxide in the 1st operation gestalt, and a fluorine atom consistency.
[Drawing 4] Drawing 4 (a) is drawing showing the cross-section configuration of the annular up edge of the processing chamber concerning the 2nd operation gestalt, and drawing showing the cross-section structure in the condition that the annular up edge and the dielectric window part were joined to drawing 4 (b).
[Drawing 5] Drawing and drawing 5 (b) which show the cross-section structure of the annular up edge of the processing chamber which drawing 5 (a) requires for the 3rd operation gestalt are drawing showing the cross-section structure in the condition that the annular up edge and the dielectric window part were joined.
[Drawing 6] It is drawing for explaining the airtight maintenance means of the vacuum processor concerning the 4th operation gestalt.
[Drawing 7] It is drawing for explaining the airtight maintenance means of the vacuum processor concerning the 5th operation gestalt.
[Drawing 8] It is cross-section structural drawing showing the notional whole configuration of the optical processor using the xenon excimer lamp concerning the 6th operation gestalt which applied the vacuum processor of this invention.
[Drawing 9] It is drawing showing the cross-section structure to which a part for the airtight maintenance hand part of the vacuum processor in drawing 8 was expanded.
[Drawing 10] It is drawing showing the example of a configuration which combined the 1st thru/or 6th operation gestalt.
[Description of Notations]
1 — processing chamber and 1a— an exhaust port, a 1b— gas inlet, a 1c— annular up edge, and 1d— a circular sulcus, 2 — exhaust air system, 3 — gas feed system, and 4 — an O ring, the interior wall (dielectric window part) of 5 —, the coil for 6 — plasma production, and 7 — a top cover, 8 — table (lower electrode), 9 — substrate, and 10 — an adjustment machine, 11 — RF generator, and 12 — plasma cutoff means.

[Translation done.]

* NOTICES *

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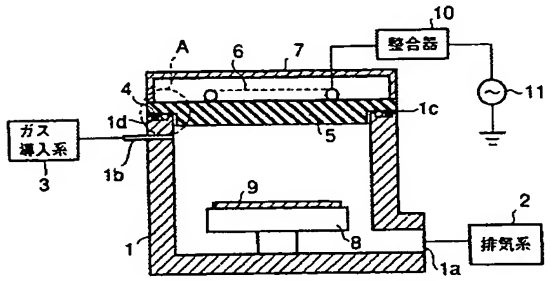
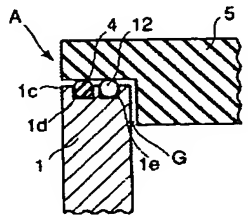
DRAWINGS

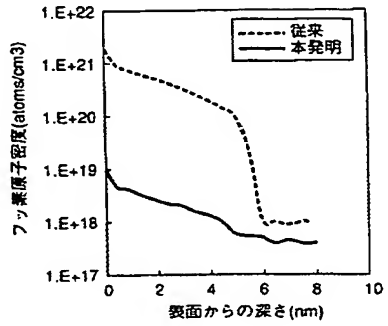
[Drawing 1]



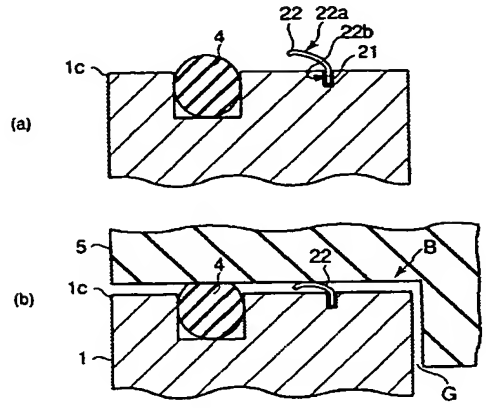
[Drawing 2]



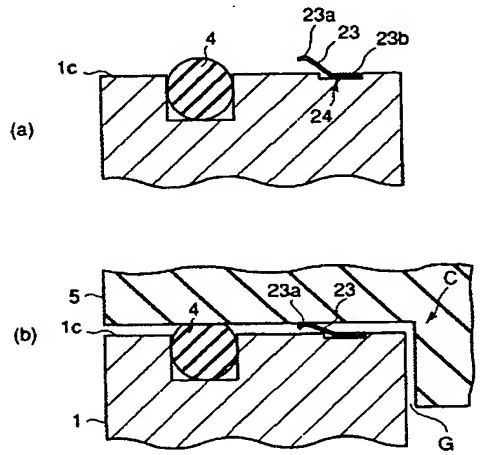
[Drawing 3]



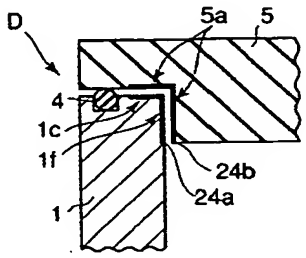
[Drawing 4]



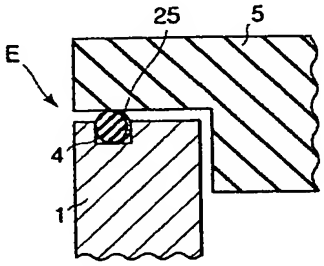
[Drawing 5]



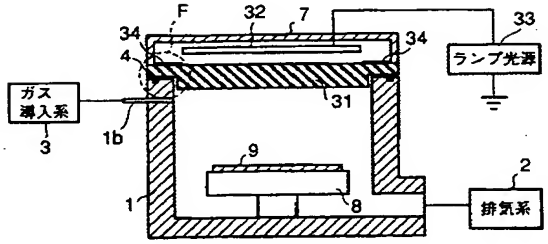
[Drawing 6]



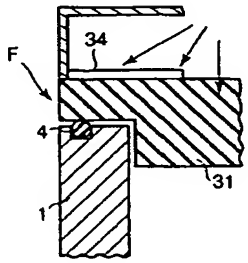
[Drawing 7]



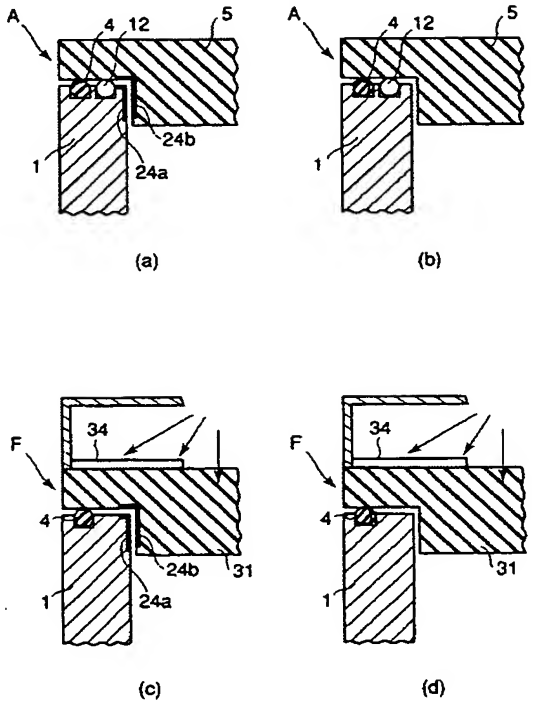
[Drawing 8]



[Drawing 9]



[Drawing 10]



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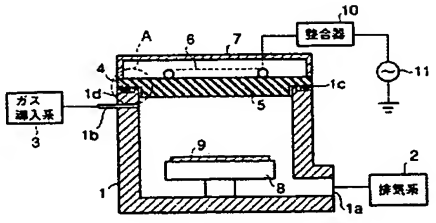
最終頁に続く

(54)【発明の名称】処理装置およびプラズマ装置

(57)【要約】
【課題】近年では高密度プラズマや照射強度の強い、またエネルギーの高い光処理が用いられており、Oリングを用いて気密を保持する気密保持部において、接合される部位の隙間を抜けてプラズマや光が侵入してOリングに到達して、Oリングの劣化や酸素活性種などの活性種との反応している。
【解決手段】本発明は、復元性を有する形状の導電性部材からなるプラズマ遮断手段１２をOリング４の処理チャンバー１側（内側）に設けて、プラズマ及び処理ガスにより生成された活性種がOリング４へ到達することを遮断して、不純物の放出やOリング４の劣化を防止すると共に、処理される被処理基板９への汚染を防止する。
【選択図】　図１



【特許請求の範囲】
【請求項１】
導入された処理ガスの雰囲気内でプラズマを発生する気密容器と、
前記気密容器の一面として取り付けられた誘電体窓部との封止面間に介在し、気密状態を保持するための気密保持手段と、
前記封止面上で、前記気密保持手段が設けられた位置よりも前記気密容器の内部側に設けられ、導電性材料からなり復元性を有する形状に成形されたプラズマ遮断手段と、を具備してなることを特徴とする処理装置。
【請求項２】
前記プラズマ遮断手段は、導電性部材により形成され、その形状は、前記導電性部材を薄帯状にしてスパイラルに巻いた形状、前記導電性部材を薄帯状にして幅方向に曲げを有した環状に成型した形状、前記導電性部材を導線にしてソレノイドコイル形状に巻いた形状若しくは、前記導線にして筒状に編み上げた形状、のいずれか１つであること特徴とする請求項１に記載の処理装置。
【請求項３】
導入された処理ガスの雰囲気内でプラズマを発生する気密容器と、
前記気密容器の一面として取り付けられた誘電体窓部との接合面間に介在し、気密状態を保持するための気密保持手段と、
前記気密容器を形成する部材よりも、前記処理ガスから生成された活性種との反応係数の高い部材からなり、前記気密保持手段が設けられた位置よりも前記気密容器の内部側の少なくとも一方の対向面上に設けられるガス遮断手段と、
を具備してなることを特徴とする処理装置。
【請求項４】
導入された処理ガスの雰囲気内でプラズマを発生する気密容器と、
前記気密容器の一面として取り付けられた誘電体窓部との封止面間に介在し、気密状態を保持するための気密保持手段と、
前記気密保持手段の前記気密容器内に向かう面上に形成される導電部材からなるガス遮断手段と、
を具備してなることを特徴とする処理装置。
【請求項５】
導入された処理ガスの雰囲気内で光エネルギーによる光分解を伴う処理を行うための気密容器と、
前記気密容器の一面として取り付けられた光透過窓部との封止面間に介在し、気密状態を保持するための気密保持手段と、
前記光透過窓部における非接合面側に設けられた光源と、
前記光源が放射した光が前記気密保持手段に向かう光路上に設けられ、前記光を遮光する遮光手段と、
を具備することを特徴とする処理装置。
【請求項６】
前記処理ガスは、少なくとも組成に酸素原子を含む反応性ガスからなることを特徴とする請求項１、３、４、５のいずれか１つに記載の処理装置。
【請求項７】
前記処理装置は、
前記気密保持手段が設けられた位置よりも前記気密容器の内部側に設けられた封止面を含む第１の面と、その第１の面に対峙する前記構成部位の第２の面のそれぞれの面上に設けられる、前記気密容器材料よりも前記処理ガスから生成された活性種との反応係数の高い部材からなるガス遮断手段を、
さらに具備することを特徴とする請求項５に記載の処理装置。
【請求項８】
プラズマを発生する気密容器と、

この気密容器を構成する容器壁面の一部が着脱自在に気密に設けられる壁体と、
この壁体と前記容器壁面との対向部を気密にシールするＯリングと、
このＯリングの前記チャンバー内側に設けられたプラズマ遮断手段と、
を具備してなることを特徴とするプラズマ装置。
【請求項９】
前記プラズマ遮断手段は、環状金属製線体、環状金属製板バネ、環状金属製梁体の少なくとも一つの手段であることを特徴とする請求項１３に記載のプラズマ装置。
【請求項１０】
処理ガスが供給される気密容器と、
この気密容器を構成する容器壁面の一部が着脱自在に気密に設けられる壁体と、
この壁体と前記容器壁面との対向部で前記壁体及び前記容器壁面の対向面上に設けられた有害ガス吸着手段と、
を具備してなることを特徴とするプラズマ装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、気密容器中において、プラズマ処理や光活性化ガスによる処理等を行う処理装置およびプラズマ装置に関する。
【０００２】
【従来の技術】
一般に、半導体装置を製造するために、例えばプラズマＣＶＤ（Ｃｈｅｍｉｃａｌ　Ｖａｐｏｒ　Ｄｅｐｏｓｉｔｉｏｎ）装置、スパッタリング装置、エッチング装置等を用いて、真空中におけるプラズマ処理により成膜やエッチングが行われている。この真空は、排気系が設けられた気密な処理チャンバーにより作り出されいる。この処理チャンバーは、例えばアルミニウムやステンレスを材料として箱状に形成され、その内部には、プラズマ発生用の電極、プロセスガス等を導入するためのガス導入系や、外部から搬入又は外部へ搬出される半導体基板（ウエハ）や表示装置用基板の搬送系との受け渡しを行うための受け渡し機構等が設けられている。また、処理チャンバーには、搬送系のためのゲートや排気系を接続するためのポートなど複数の開口部が設けられている。
【０００３】
これらの開口部にそれぞれ構成部位を取り付ける場合は、気密性を持たせるために、気密保持用部材（シール部材）を挟んで取り付けられている。この気密保持用部材としては、メタルガスケット、ゴム等から成るＯリングが主として用いられている。これらのうち、メタルガスケットは、処理チャンバーへのフランジ接合に用いられる場合が多い。このメタルガスケットは、気密性が高く、熱や処理ガス（腐食性ガスや酸素活性種のガスを含む）に対しても耐久性を有しているが、繰り返し利用することができないため、使い捨てとなっている。一方、Ｏリングは、ウエハを出し入れするためにその都度開閉するゲート蓋やビューイングポート（ガラス）を処理チャンバーに窓として取り付ける際などに気密シール材として用いられている。つまり、繰り返し開閉する部分やガラスなどのメタルガスケットを利用できない部位に対して用いられている。
【０００４】
【特許文献１】
特開平５－３１５２６２号公報、（段落番号［００１２］～［００１５］）
【０００５】
【特許文献２】
特開平５－３１５２６１号公報、（段落番号［００１３］）
【０００６】
【特許文献３】
特開２００２－２１７１３７公報、（段落番号［００１４）～［００１８））
【０００７】

【特許文献４】
特開２００２－１６４６８５公報、（段落番号［００１５）、［００２０））
【０００８】
【発明が解決しようとする課題】
前述したＯリングは、シール部材としては繰り返し利用でき、安価であるため、真空処理装置に多用されている。しかし、基板処理において、プラズマ処理やガス雰囲気内に処理ガス例えば、酸素ガスにより生成された酸素活性種（ここでは、酸素原子若しくはオゾン等）が含まれていた場合、プラズマや酸素活性種にＯリングが晒され、Ｏリングの表面が化学的に反応して、Ｏリングが劣化する。また、この反応に伴い、Ｏリングから炭素やフッ素等の不純物が処理雰囲気中に放出されるため、被処理基板内に不純物が浸透する虞がある。通常の酸化処理やエッチング処理では、酸素ガスを始めとする反応性ガスを用いる場合が多い。この対策として、耐腐食性のＯリングを用いることもできるが、高額であり、製品コストに影響を及ぼすこととなる。
【０００９】
そこで、例えば、特許文献１においては、処理チャンバー本体でＯリングが取り付けられた位置より内側に凹部を設け、取り付ける構成部位側に、この凹部と嵌合する凸部を設ける。この構成部位を処理チャンバー本体に取り付けた場合、凹部と凸部が嵌合して、処理ガスやプラズマが回り込みにくくなるように工夫されている。また、特許文献２は、フッ素樹脂等の遮断部位をＯリングより内側に配置することにより、プラズマ及び処理ガスがＯリングに接触しないようにして、Ｏリングの劣化を防止する技術を提案している。
【００１０】
一般に、Ｏリングにより気密保持を行うための構成部位どうしの隙間は、０．１～０．３ｍｍ程度が好適するとされている。しかし、経時変化によるＯリングの硬度変化による隙間の変化や、処理装置における熱の履歴等により接合部分に発生した反りや歪みによる隙間の変化がある。これらのプラズマや処理ガスは、この隙間の変化により、隙間に回り込んで浸入してＯリングへ到達する。
【００１１】
また特許文献３は、適度にＯリングが潰れて気密性を保てるように、樹脂ストッパーを用いて最適な隙間を維持する技術を開示している。開示されている樹脂材料からなるストッパーは、プラズマや処理ガス（活性種）に晒されると、反応して有機物を放出することが考えられるため、プラズマや処理ガスの浸入を防止する隙間が規定されている。
【００１２】
しかし、近年ではデバイスの高集積化や処理速度の高速化への要望から高密度プラズマや照射強度の強い、またエネルギーの高い光処理が用いられており、従来では、最適と考えられていた０．１～０．３ｍｍ程度の隙間にもプラズマや光が侵入している。
このプラズマの浸入を防止するものとして、特許文献４には、Ｏリングの外周側に傾斜コイルばねを配置して、接合する構成部位（例えば、処理チャンバーと蓋）どうしを電気的に接続して、磁気シールドを行う技術が開示されている。この特許文献４では、傾斜コイルばねがＯリングの外周側に配置されており、プラズマ側（内側）にＯリングが存在するため、Ｏリングはプラズマに晒されていることが考えられる。
【００１３】
そこで本発明は、真空雰囲気下で発生するプラズマや処理に用いる活性種を含む処理ガスによる気密保持手段への損傷を防止する処理装置およびプラズマ装置を提供することを目的とする。
【００１４】
【課題を解決するための手段】
本発明は上記目的を達成するために、導入された処理ガスの雰囲気内でプラズマを発生する気密容器と、前記気密容器の一面として取り付けられた誘電体窓部との封止面間に介在し、気密状態を保持するための気密保持手段と、前記封止面上で、前記気密保持手段が設けられた位置よりも前記気密容器の内部側に設けられ、導電性材料からなり復元性を有す

る形状に成形されたプラズマ遮断手段とを具備してなる処理装置を提供する。

【００１５】

また、前記プラズマ遮断手段は、導電性部材により形成され、その形状は、前記導電性部材を薄帯状にしてスパイラルに巻いた形状、前記導電性部材を薄帯状にして幅方向に曲げを有した環状に成型した形状、前記導電性部材を導線にしてソレノイドコイル形状に巻いた形状若しくは、前記導線にして筒状に編み上げた形状、のいずれか１つである。

【００１６】

さらに、プラズマを発生する気密容器と、この気密容器を構成する容器壁面の一部が着脱自在に気密に設けられる壁体と、この壁体と前記容器壁面との対向部を気密にシールするＯリングと、このＯリングの前記チャンバー内側に設けられたプラズマ遮断手段とを具備してなるプラズマ装置を提供する。

【００１７】

以上のような構成の処理装置およびプラズマ装置は、復元性を有する形状の導電性部材からなるプラズマ遮断手段をＯリングからなる気密保持手段を処理チャンバー側に設けて、プラズマ及び処理ガスにより生成された活性種がＯリングへ到達することを遮断して、不純物の放出やＯリングの劣化が防止される

【００１８】

【発明の実施の形態】

以下、図面を参照して本発明の実施形態について詳細に説明する。

図１は、本発明の処理装置を適用した第１の実施形態として、誘導結合型プラズマ処理装置の概念的な全体構成を示す断面図である。図２は、真空処理装置の気密保持部分を拡大した断面構成を示す図である。

【００１９】

この真空処理装置は、アルミニウムやステンレス等からなる処理チャンバー１と、処理チャンバー１の排気ポート１ａに接続される排気系２と、ガス導入口１ｂに接続されて処理ガスやパージガス等を気密容器例えば処理チャンバー１内へ導入するガス導入系３とが設けられている。この処理チャンバー１の上面は開口され、その環状上端部１ｃには、一周に亘り環状溝１ｄが形成されて、この環状溝１ｄには、気密保持手段として、例えば、ゴム材料からなるＯリング４が一部露出して嵌め込まれている。この露出量は、気密シール（封止）されたとき、隙間Ｇが形成される間隔である。

【００２０】

さらに、ガラス等の誘電体により形成される内部壁部（誘電体窓部）５は、処理チャンバー１の環状上端部１ｃへＯリング４を適正に潰して気密になるように取り付けられている。この誘電体窓部５の上面（チャンバー外側）には、プラズマ生成用コイル６（上部電極）が配置される。さらに、プラズマ生成用コイル６を覆うように誘電体窓部５の上方に上蓋７が取り付けられている。この上蓋７が誘電体窓部５を押圧するように取り付けて、環状上端部１ｃのＯリング４を適正に潰して処理チャンバー１内の気密性を持たせるように機能させてもよい。処理チャンバー１内の底部には、半導体ウエハや表示装置用基板等の被処理基板９を保持し且つこの被処理基板９の温度調整を行う機能を有するテーブル（下部電極）８が設けられる。

【００２１】

この被処理基板９は、処理チャンバー１の側壁の設けられた図示しないゲートを介して搬入出される。または被処理基板９は、誘電体窓部５を開閉操作し、上方から被処理基板９を出し入れすることも可能である。前述したプラズマ生成用コイル６は、整合器１０を介して、例えば１３．５６ＭＨｚの高周波電力を出力する高周波電源１１に接続される。尚、以下の説明において、処理チャンバー１の内壁側（若しくは処理室側）は内側と称し、処理チャンバー１の外壁側は外側と称している。

【００２２】

誘電体窓部５の上面（チャンバー外側）に、プラズマを生成するためのマイクロ波電源に接続された導波管を設けることもできる。

【００２３】
この処理装置は、酸化膜を形成するプラズマ成膜処理装置（ＣＶＤ）を例として説明しているが、勿論これに限定されるものではなく、プラズマ及び／若しくは反応性ガスによる処理装置のＯリング４による気密保持手段に適用して有効である。気密保持手段を有する処理装置としては、例えば、プラズマＣＶＤ装置、熱ＣＶＤ装置、光ＣＶＤ装置、スパッタリング装置、エッチング装置、アッシャー装置等がある。
【００２４】
次に図２に示す気密保持手段Ａについて説明する。
この気密保持手段Ａは、誘電体窓部５の周縁部と処理チャンバー１の環状上端部１ｃとが対接したとき気密シールするものである。この環状上端部１ｃのＯリング４が嵌め込まれた環状溝１ｄより内側（処理室側）に同様な環状溝１ｅが形成されている。この環状溝１ｅには、導電性材料によりバネのような復元性を有する形状に形成されたプラズマ遮断手段１２が気密シールされたとき一部露出するように嵌め込まれる。このプラズマ遮断手段１２は、接触するプラズマにより腐食しない材料例えば、金属等の導電性部材からなる。プラズマ遮断手段の形状としては、金属の薄く細長い（帯状）鋼板をスパイラル状に巻いたものでもよいし、導線をソレノイドコイル形状に巻いたもの若しくは、筒状に編み上げてもよい。
【００２５】
このプラズマ遮断手段１２の金属としては、ステンレス、アルミニウム、銅、鉄等やこれらの合金などが想定される。また、これらの金属や合金に対して、耐腐食の表面処理を行ってもよい。以下の実施形態のおける導電性部位も同様である。
【００２６】
誘電体窓部５と環状上端部１ｃとが接合された際には、プラズマ遮断手段１２がこれらの両方に当接し、Ｏリングが潰れることにより気密性が実現すれば、隙間Ｇの幅は限定されない。しかし、この隙間Ｇの幅は、プラズマ遮断手段１２までプラズマが浸入して到達しない、例えば、０．１ｍｍ以下の隙間が好ましい。
【００２７】
次に処理工程の例について説明する。被処理体基板９として例えば、半導体ウエハは、処理チャンバー１内に搬入され、テーブル８上に載置される。その後、排気系２は、処理チャンバー１内の大気やパージガスを排気し、設定された真空度に到達した後、ガス導入系３から例えば、処理ガスとして酸素ガス（O_2）を導入して、所定圧力で維持される酸素雰囲気を形成する。次いで、高周波電力をプラズマ生成用コイル６から誘電体窓部５を介して処理チャンバー１内に投入して、酸素雰囲気のプラズマを発生させる。このプラズマにより、処理ガスから生成された活性種が発生する。尚、この処理ガスとしては、酸素ガス等の活性ガスや、ＲＩＥ等に用いられる腐食性を有する反応性ガスも含んでいるものとする。以下の実施形態においては、酸素ガスにより生成された活性種（酸素活性種）による酸化処理を例として説明しているが、これに限定されるものではない。ここで、酸素活性種は、活性酸素に限らず、酸素イオン（O^+、O_2^+）やオゾンおよび酸素原子を含むその他の活性種を含めて酸素活性種としている。
【００２８】
さらに半導体ウエハを３００℃程度に加熱することによって、半導体ウエハのシリコンをプラズマ酸化させる。この酸化処理では、３０分程度の処理時間によって表面から約６ｎｍの深さ（厚さ）のシリコン酸化膜が形成される。
【００２９】
このシリコン酸化膜に対して、ＳＩＭＳ（Ｓｅｃｏｎｄａｒｙ Ｉｏｎ Ｍａｓｓ ｓｐｅｃｔｒｏｓｃｏｐｙ：２次イオン質量分析法）を用いて、シリコン酸化膜中のフッ素量を測定し、本実施形態のようにプラズマ遮断手段１２及びＯリングを設けた例と、従来のようにプラズマ遮断手段１２を設けず、Ｏリングのみによる例について説明する。測定結果として、図３には、厚さ６ｎｍのシリコン酸化膜の表面からの深さとフッ素原子密度との関係が示されている。

【００３０】
この図３によれば、従来のＯリング４のみでプラズマ遮断手段１２を設けなかった例では、点線で示されているように成膜されたシリコン酸化膜の深さが５ｎｍを越えるまでシリコン酸化膜中に多くのフッ素が含有されている。これに対して、本実施形態によるプラズマ遮断手段１２を設けた例では、実線で示されているようにフッ素原子密度が表面でも１０^{19}ａｔｏｍｓ／ｃｍ^{3}以下となり、従来に比べ２桁減少していることが判明した。
【００３１】
以上のように本実施形態によれば、復元性を有する形状の導電性部材からなるプラズマ遮断手段１２をＯリング４の内側に配置することにより、プラズマ及び処理ガスがＯリング４へ影響を与えることを防止することができる。率いては、Ｏリング４から発生する炭素やフッ素等の不純物が被処理基板９内へ浸透するのを防止できる。さらに、プラズマ遮断手段１２は、Ｏリング４から炭素やフッ素等の不純物が発生しても処理チャンバー１内に拡散するのを防止する。またプラズマ遮断手段１２の材料に有機物を用いると、プラズマに晒された場合には、不純物の放出が問題となるが、その材料が金属（導電体）であれば不純物の放出が防止できる。さらに、熱的にも金属材料の方が安定的であるため、被処理基板９の温度が３００℃程度の酸化処理等には望ましい。
【００３２】
次に、第２の実施形態に係る真空処理装置における気密保持手段１２について説明する。図４（ａ）は、処理チャンバー１の環状上端部１ｃの断面構造を示し、図４（ｂ）には環状上端部１ｃと誘電体窓部５の対向部とが接合された状態の気密保持手段Ｂの断面構造を示す図である。装置構成として、図示される以外の構成においては、図１に示した構成と同等である。また本実施形態の構成部位で、前述した第１の実施形態と同等の部位については、同じ参照符号付して、その説明を省略する。
【００３３】
図４（ａ）に示すように、処理チャンバー１の環状上端部１ｃにＯリング４とプラズマ遮断手段２２が配置される。Ｏリング４が嵌め込まれた溝より内側に環状スリット２１を環状上端部１ｃの一周に亘り形成する。プラズマ遮断手段２２は、金属材料からなる薄板で板バネのように帯状に形成され、その幅方向に梁部２２ａと差し込み部２２ｂを持つように曲げて成形される。このプラズマ遮断手段２２の差し込み部分２２ｂは、環状スリット２１へ一周に亘り気密に差し込まれる。この薄板の厚さは、バネのように復元性を有する厚さであれば薄い方がよい。
【００３４】
そして、図４（ｂ）に示すように、環状上端部１ｃと誘電体窓部５とが接合された場合には、プラズマ遮断手段２２の梁部２２ａが誘電体窓部５に押されて曲がりつつ、誘電体窓部５に隙間無く当接する。これと共にＯリング４が適正に潰されて気密性が実現する。
【００３５】
この第２の実施形態よれば、第１の実施形態と同様に、プラズマ遮断手段２２は、プラズマを遮断して、Ｏリング４までプラズマが到達させないようにすることができる。これにより炭素やフッ素ガスなどがＯリングから発生し処理チャンバー１内に拡散するのを防止することができる。また、簡単な構成で安価に作製でき、且つ洗浄や交換などのメンテナンスが容易にできる。さらに、接合時の環状上端部１ｃと誘電体窓部５との隙間Ｇを狭く、例えば０．１ｍｍ以下にできれば、処理ガスにから生成された活性種も浸入しにくくなる。
【００３６】
次に、第３の実施形態に係る真空処理装置の気密保持手段について説明する。図５（ａ）は、処理チャンバーの環状上端部の断面構造を示し、図５（ｂ）は、環状上端部１ｃと誘電体窓部５とが接合された状態の気密保持部分Ｃの断面構造を示す図である。尚、ここで本実施形態の構成部位で、前述した第１の実施形態と同等の部位については、同じ参照符号付して、その説明を省略する。
【００３７】

図５（ａ）に示すように、処理チャンバー１の環状上端部１ｃにＯリング４とプラズマ遮断手段２３が配置される。このプラズマ遮断手段２３は、幅方向で梁部２３ａと取り付け部２３ｂとからなる環状に、絞り成型やプレス成型を用いて作製される。このプラズマ遮断手段２３は、Ｏリング４よりも内側に配置され、取り付け部２３ｂが環状上端部１ｃのザグリ部分２４へ気密に固定され、梁部２３ａが上方に立ち上がった状態となっている。

【００３８】

図５（ｂ）に示すように、環状上端部１ｃと誘電体窓部５とが接合された場合には、プラズマ遮断手段２３の梁部２３ａが誘電体窓部５に押されて曲がりつつ、誘電体窓部５に隙間無く当接させる。更に、Ｏリング４が適正量潰されて気密性が実現する。

【００３９】

この第３の実施形態よれば、第１の実施形態と同様に、プラズマ遮断手段２３はプラズマの浸入を遮断して、Ｏリング４まで到達させないようにすることができる。また、簡単な構成で安価に作製でき、且つ洗浄や交換などのメンテナンスが容易にできる。本実施形態においても、接合時の環状上端部１ｃの上面と誘電体窓部５側壁面との隙間Ｇを狭く０．１ｍｍ以下にできれば、処理ガスにから生成された活性種も浸入しにくくなる。

【００４０】

前述した第２、第３の実施形態におけるプラズマ遮断手段２２、２３は、金属材料で形成していたが、これを形状記憶合金で作製し、近傍にヒータ等を設けて、稼働時にプラズマ遮断手段２２、２３を誘電体窓部５に当接するように立ち上げてもよい。

【００４１】

また、前述した第１、２、３の実施形態においては、Ｏリング４より内側（処理チャンバー１側）にプラズマ遮断手段１２、２２、２３を設けたとしても接合する構成部位がガラスからなる誘電体窓部５であるため、プラズマ遮断手段１２、２２、２３との摩擦は小さく、パーティクルは発生しにくいため、被処理基板９に対してほとんど影響を与えない。また、硬度のあるガラスを選択したり、ガラス表面を強化加工したり、さらに表面が平滑になるように研磨することにより、パーティクルの発生をより少なくすることができる。

【００４２】

次に、第４の実施形態に係る真空処理装置の気密保持手段について説明する。図６に示すように本実施形態では、処理チャンバー１の環状上端部１ｃの内壁面上部１ｆとこれに続く環状上端部１ｃのＯリング４より内側上面部分に、侵入してきた処理ガス、例えば、活性種を表面反応によって吸着（消滅）させる被膜２４ａを形成する。また、接合時に環状上端部１ｃの被膜２４ａと対峙する誘電体窓部５の面５ａに同様な被膜２４ｂを形成する。

【００４３】

この被膜２４ａ、２４ｂは、酸素吸着材として機能する被膜であり、例えば、処理チャンバー１をステンレスで形成した場合には、被膜材料として装置内壁よりも酸素との反応係数（表面損失係数）が大きいものであればよく、アルミニウム（Ａｌ）、タンタル（Ｔａ）若しくは、ニッケル（Ｎｉ）といった表面損失係数の大きな材料が好ましい。この被膜２４ａ、２４ｂの形成方法としては、蒸着法により形成したり、直接的に吹き付ける溶射法を用いてもよい。また、接合時の処理チャンバーの環状上端部１ｃと誘電体窓部５の隙間Ｇは、０～０．３ｍｍの範囲内で、例えば０．１ｍｍ以下の隙間が好ましい。

【００４４】

本実施形態では、酸化膜の成膜の場合、酸素活性種の侵入経路に装置内壁や誘電体窓部５よりも表面損失係数の高い部材による被膜５ａを設けることにより、酸素活性種を被膜５ａの表面で反応または再結合させて、Ｏリング４へ到達して反応する活性種の量を減少させることが可能となる。

【００４５】

本実施形態においても前述した第１、２の実施形態と同様に、半導体ウエハにプラズマ酸化を施して、シリコン酸化膜を形成した場合と同様に、シリコン酸化膜中のフッ素原子密度は、従来に比べて低下したことを確認した。尚、ここでは、酸素ガスに適用した例につ

いて説明したが、他のプロセスガスにおいても同様に好適する被膜材料を適宜選択することにより適用することができる。

【００４６】

次に、第５の実施形態に係る真空処理装置の気密保持手段Ｅについて説明する。

【００４７】

本実施形態は、図７に示すように処理チャンバー１の環状上端部１ｃに嵌め込まれるＯリング４に対して、真空側のＯリング４表面に金属皮膜２５をメッキ法、若しくはスパッタリング法などを用いて形成する。Ｏリング４と金属皮膜２５とは、弾性係数（膨張率）が異なっているため、Ｏリング４の全表面を金属皮膜２５で覆うと、Ｏリング４の伸縮時にひび割れや剥がれが発生しやすくなる。そこで、金属皮膜２５はＯリング４表面の一部に形成することが望ましい。金属皮膜２５の材料としては、ひび割れを防ぐ意味で弾性がＯリング４に近い（やわらかい）材料が好ましい。この金属皮膜２５の材料としては、銅、アルミニウム若しくは、白金等が考えられる。

【００４８】

本実施形態によれば、Ｏリング４に対してプラズマや活性種が直接的に触れることがなくなったため、被処理基板９を汚染する不純物濃度は大きく低下させることができ、前述した第１の実施形態と同等の効果を得ることができる。尚、この金属皮膜は、必ずしも金属材料によるものである必要はなく、プラズマや活性種に触れたときに発生して問題となる不純物が組成に含まれていない材料による皮膜を形成すればよい。これにより、Ｏリング４を構成する有機物と活性種が反応することがなくなるため、フッ素、炭素等の不純物の放出を抑制し、且つＯリング４の劣化を防止することができる。

【００４９】

次に図８は、本発明の真空処理装置を適用した第６の実施形態として、キセノンエキシマランプを用いた光処理装置の概念的な全体構成を示す断面構成図である。図９は、真空処理装置の気密保持手段を拡大した断面構成を示す図である。尚、ここで本実施形態の構成部位で、前述した第１の実施形態と同等の部位については、同じ参照符号付して、その説明を省略する。

【００５０】

この真空処理装置は、前述した処理チャンバー１と、排気系２と、ガス導入系３と、気密性を図るためのＯリング４と、透明な石英ガラス等による内部壁部（光透過窓部）３１と、この光透過窓部３１の上面（チャンバー外側）に配置されるキセノンエキシマランプ（以下、ランプと称する）３２と、上蓋７と、ランプ３２を発光させるためのランプ電源３３とで構成される。処理チャンバー１内の底部には、被処理基板９を保持し、被処理基板９の処理温度調整機能を有するテーブル８が設けられている。また被処理基板９の搬入出用の図示しないゲートを備えている。この真空処理装置において、処理チャンバー１の環状上端部１ｃと光透過窓部３１とは、Ｏリング４を介在させて気密を実現させている。

【００５１】

この真空処理装置は、処理チャンバー１内を排気して所定真空度に到達した後に、ガス導入系３によりO_2ガスを導入して所望する圧力の酸素雰囲気を生成する。この酸素雰囲気へランプ３２による波長１７２ｎｍの光（光エネルギー）を放射してO_2ガスを光分解させて、処理チャンバー１内に素原子やオゾンを発生させ、テーブル８により３００℃に加熱された被処理基板９の表面を酸化処理する。

【００５２】

この構成においては、ランプ３２からの放射光が光透過窓部３１を透過し、Ｏリング４に照射されてしまう。照射された場合には、Ｏリング４が強い紫外光によって劣化する。さらに、この放射光によって酸素活性種がＯリング４周辺でも生成されるため、Ｏリング４と酸素活性種が反応して、Ｏリング４から炭素、フッ素等の不純物が放出される。そこで本実施形態は、ランプ３２からＯリング４へ向かう放射光の光路上に遮光板３４を設けて、Ｏリング４に照射される放射光を遮光する。この遮光板３４は、放射光を遮光でき、光源の熱により溶解しない材料により形成されればよく、例えば高融点金属等が考えられる

。勿論、処理ガスは、酸素ガスに制限されるものではなく、被処理基板９への成膜、エッチング、拡散等の処理に用いる腐食性を有する処理ガスに適用できる。

【００５３】

本実施形態の光処理装置は、図５に示すようにランプ３２とＯリング４との光路上に遮光板を設けて、Ｏリング４及びその付近へ光が照射されることを無くし、Ｏリング４と酸素活性種との反応を防止することができる。

【００５４】

以上の説明した本発明は、気密保持手段にＯリング４を用いているすべての装置に対して効果を得ることができるが、装置内でプラズマ密度が高い部分に適用するのがもっとも効果的である。前述した第１、２の実施形態に示した誘電体窓部５と処理チャンバーとが接合される部分は、最もプラズマ密度が高い箇所であり、また気密にさせるための手段としてＯリング４以外の気密保持手段の使用が困難であるため、本発明の効果がもっとも発揮されている。

【００５５】

また、プラズマ処理装置に関する真空処理装置においては、プラズマ源の種類にはよらず効果を得ることができる。また、プラズマに限らず原料ガスを分解するためのエネルギーが供給されていればよい。

【００５６】

さらに、キセノンエキシマランプを光源として用いた光処理装置の気密保持手段においても、Ｏリング４への光の照射を遮光したため、紫外光によるＯリング４の劣化やＯリング付近で酸素活性種等の活性種の発生を抑制することができる。

【００５７】

また、本実施形態における光処理装置の他にも、白熱球やハロゲンランプやフラッシュランプを用いた各アニール装置、成膜装置（ＣＶＤ等）内に搭載されるランプ加熱室等に適用することかできる。

【００５８】

尚、前述した各実施形態において、それぞれの実施形態を組み合わせて実施することも可能である。

第１例として、図１０（ａ）に示すように、第１の実施形態におけるプラズマ遮断手段１２と、第４の実施形態における酸素吸着材として機能する被膜２４ａ、２４ｂとを組み合わせることにより、プラズマ遮断手段１２によりプラズマを遮断し、被膜２４ａ、２４ｂにより活性種を吸着して、プラズマ及び活性種がＯリング４に到達することを防止する。

【００５９】

第２例として、図１０（ｂ）に示すように、第１の実施形態におけるプラズマ遮断手段１２と第５の実施形態のＯリング４を組み合わせた構成によれば、プラズマ遮断手段１２を通過したプラズマ及び活性種がＯリング４に到達することがあっても、Ｏリング４の劣化を防止することができる。更に、第１例に第５の実施形態を組み合わせて、プラズマ遮断手段１２及び被膜２４ａ、２４ｂを通過してしまったプラズマ及び活性種がＯリング４に到達することがあっても、Ｏリング４の劣化を防止することができる。同様に、第２、第３の実施形態に対しても、第４、第５の実施形態をそれぞれ組み合わせれば、同じ効果を得ることができる。

【００６０】

第３例として、図１０（ｃ）に示すように、第６の実施形態の真空処理装置と、第４の実施形態における酸素吸着材として機能する被膜２４ａ、２４ｂとを組み合わせることにより、光分解で発生した処理ガスによる活性種を被膜２４ａ、２４ｂにより吸着して、活性種がＯリング４に到達することを防止することができる。

【００６１】

第４例として、図１０（ｄ）に示すように、第６の実施形態の真空処理装置と、第５の実施形態における金属皮膜２５が設けられたＯリング４とを組み合わせることにより、光分解で発生した処理ガスによる活性種、例えば酸素活性種がＯリング４に到達することがあ

っても、Ｏリング４の劣化を防止することができる。また、第３例に第５の実施形態を組み合わせてもよい。

【００６２】

上記実施形態では、プラズマを生成するための電磁波通過窓として利用される誘電体を気密にシールする例について説明したが、被処理体を出入させる金属製開閉弁の気密保持手段に適用してもよい。

【００６３】

【発明の効果】

以上詳述したように本発明によれば、真空雰囲気下で発生するプラズマや処理に用いる酸素活性種を含む処理ガスによる気密保持用材への損傷を防止する真空処理装置を提供することができる。

【図面の簡単な説明】

【図１】本発明の真空処理装置を適用した第１の実施形態に係る誘導結合型プラズマ処理装置の概念的な全体構成を示す断面構成図である。

【図２】第１の実施形態の真空処理装置の気密保持部分を拡大した断面構成を示す図である。

【図３】第１の実施形態におけるシリコン酸化膜の表面からの深さとフッ素原子密度との関係を示す図である。

【図４】図４（ａ）は、第２の実施形態に係る処理チャンバーの環状上端部の断面構成を示す図、図４（ｂ）には環状上端部と誘電体窓部とが接合された状態の断面構造を示す図である。

【図５】図５（ａ）は、第３の実施形態に係る処理チャンバーの環状上端部の断面構造を示す図、図５（ｂ）は、環状上端部と誘電体窓部とが接合された状態の断面構造を示す図である。

【図６】第４の実施形態に係る真空処理装置の気密保持手段について説明するための図である。

【図７】第５の実施形態に係る真空処理装置の気密保持手段について説明するための図である。

【図８】本発明の真空処理装置を適用した第６の実施形態に係るキセノンエキシマランプを用いた光処理装置の概念的な全体構成を示す断面構造図である。

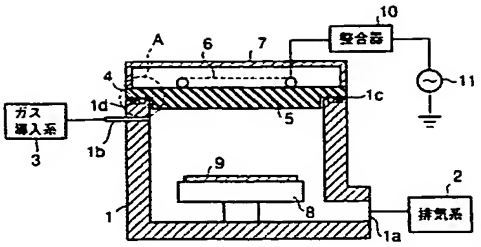
【図９】図８における真空処理装置の気密保持手部分を拡大した断面構造を示す図である。

【図１０】第１乃至第６の実施形態を組み合わせた構成例を示す図である。

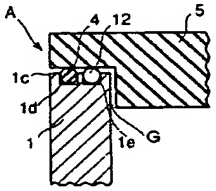
【符号の説明】

１…処理チャンバー、１ａ…排気ポート、１ｂ…ガス導入口、１ｃ…環状上端部、１ｄ…環状溝、２…排気系、３…ガス導入系、４…Ｏリング、５…内部壁部（誘電体窓部）、６…プラズマ生成用コイル、７…上蓋、８…テーブル（下部電極）、９…基板、１０…整合器、１１…高周波電源、１２…プラズマ遮断手段。

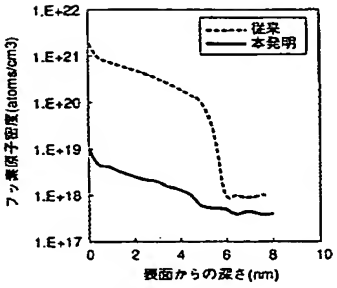
【図１】



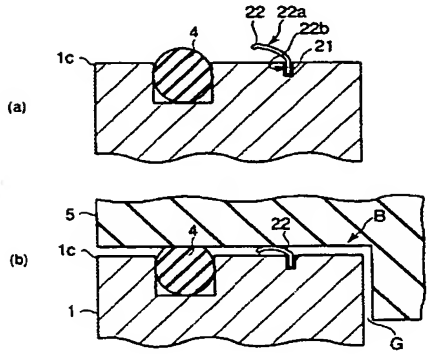
【図２】



【図３】



【図４】



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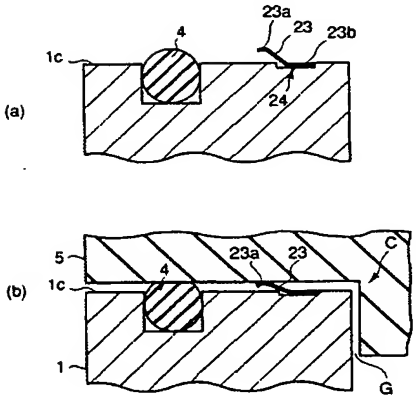

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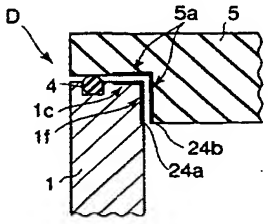

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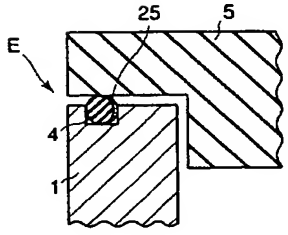

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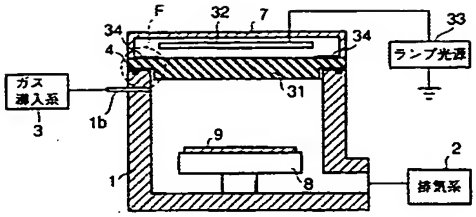
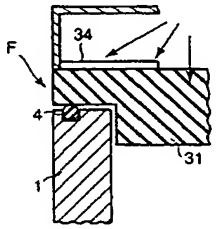
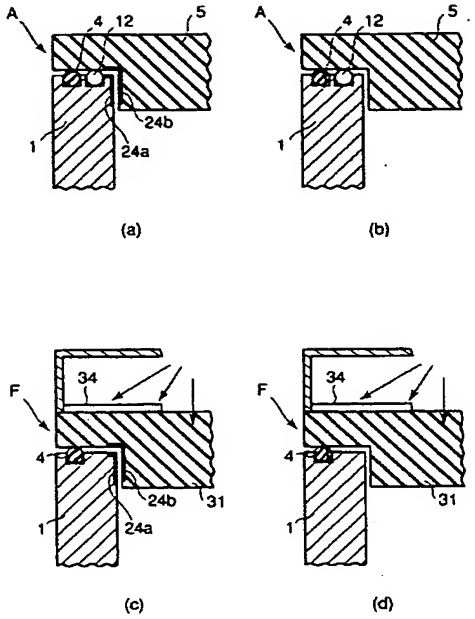

F
32
7
33
34
4
34
ランプ光源
ガス
導入系
31
1b
3
9
2
1
8
排気系

【図９】


34
F
4
31
1

【図１０】


A
4
12
5
24b
24a
1
(a)
(b)
F
34
31
(c)
(d)

フロントページの続き

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